Chapter 5
Air Quality and Climate

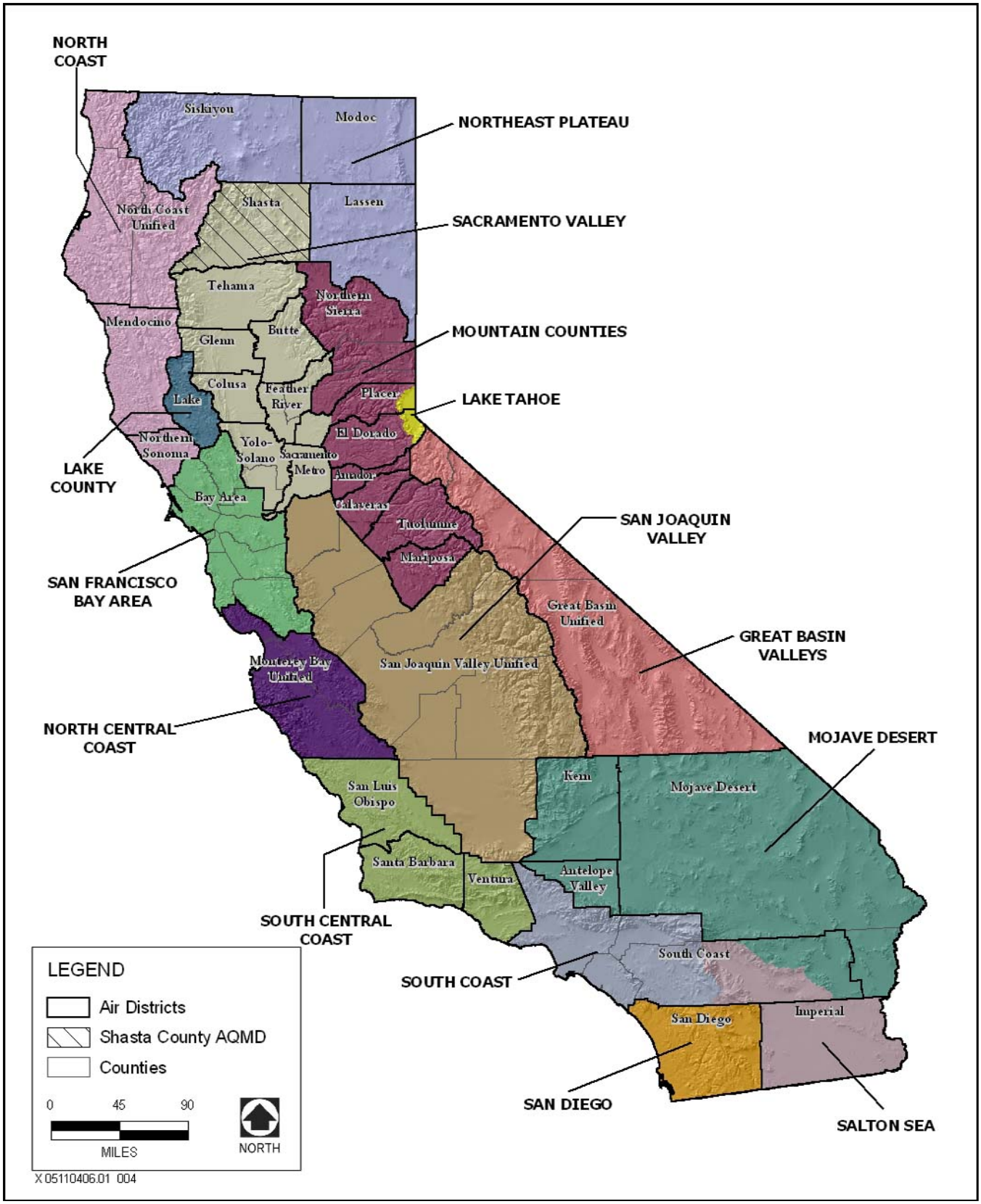
5.1 Affected Environment

This section describes existing air quality conditions in the primary study area for the dam and reservoir modifications proposed under the SLWRI. The climate and the emissions of criteria air pollutants and toxic air contaminants (TAC) at Shasta Lake and vicinity and the upper Sacramento River from Shasta Dam to Red Bluff are described. In addition, the attainment status of Shasta County relative to national and State air quality standards is summarized.

The primary study area for air quality analysis has two components—local and regional. The local area is the area immediately surrounding Shasta Dam and Shasta Lake where project construction would occur. Regionally, Shasta and Tehama counties are located in the Northern Sacramento Valley Air Basin (NSVAB), a subarea of the Sacramento Valley Air Basin (SVAB). The SVAB also includes all of Butte, Colusa, Glenn, Sacramento, Sutter, Yolo, and Yuba counties; the western portion of Placer County; and the eastern portion of Solano County. Figure 5-1 depicts the locations of these air basins, highlighting the Shasta County Air Quality Management District (SCAQMD) area. The NSVAB includes the seven counties located in the northern portion of the Sacramento Valley: Butte, Colusa, Glenn, Shasta, Sutter, Tehama, and Yuba.

The SLWRI would not include any construction or operational activities in the extended study area (the lower Sacramento River and Delta and the CVP and SWP service areas) that would affect air quality. Therefore, this section only minimally discusses air quality conditions in the extended study area. Details about conditions in the extended study area are available in the *Air Quality and Climate Technical Report*.

This section also summarizes current climate change effects of greenhouse gas (GHG) emissions on what is referred to in this chapter as the “global study area.”



Source: ARB 2004; data compiled by AECOM in 2011

Figure 5-1. Air Basins in California, Including the SCAQMD Area

5.1.1 Regional Climate in the Primary Study Area

The NSVAB is bounded on the north and west sides by the Coast Ranges and on the east side by the southern portion of the Cascade Range and the northern portion of the Sierra Nevada. These mountain ranges provide a substantial physical barrier to locally created air pollution, as well as pollution transported northward on prevailing winds from the Sacramento metropolitan area (NSVPAD 2010). The valley is often subject to inversion layers that, coupled with geographic barriers and high summer temperatures, create high potential for air pollution problems.

5.1.2 Criteria Air Pollutants

Concentrations of the following air pollutants are used as indicators of ambient air quality conditions: ozone, carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), respirable and fine particulate matter (PM_{10} and $PM_{2.5}$), and lead. Because these are the most prevalent air pollutants known to be deleterious to human health, they are commonly referred to as "criteria air pollutants."

Each criteria air pollutant is described briefly below. A more in-depth discussion is provided in the *Air Quality and Climate Technical Report*.

Ozone

Ozone is a photochemical oxidant and the primary component of smog. Ozone is not directly emitted into the air, but is formed through complex chemical reactions between precursor emissions of reactive organic gases (ROG) and oxides of nitrogen (NO_X) in the presence of sunlight. ROG are volatile organic compounds (VOC). ROG emissions result primarily from incomplete combustion and the evaporation of chemical solvents and fuels. NO_X are a group of gaseous compounds of nitrogen and oxygen that results from the combustion of fuels.

Ozone located in the lower atmosphere is a major health and environmental concern. Meteorology and terrain play a major role in ozone formation. Low wind speeds or stagnant air coupled with warm temperatures and clear skies provide the optimum conditions for ozone formation. Therefore, summer is the peak ozone season. Ozone is a regional pollutant that often affects large areas. Ozone concentrations over or near urban and rural areas reflect an interplay of emissions of ozone precursors, transport, meteorology, and atmospheric chemistry (Godish 2004).

Carbon Monoxide

CO is a colorless, odorless, and poisonous gas produced by incomplete burning of carbon in fuels, primarily from mobile (transportation) sources. Approximately 77 percent of the nation's CO emissions are from mobile sources. The other 23 percent consist of CO emissions from wood-burning stoves, incinerators, and industrial sources. The highest concentrations are generally associated with cold, stagnant weather conditions that occur during

winter. In contrast to ozone, which is a regional pollutant, CO causes problems on a local scale.

Nitrogen Dioxide

NO_2 is a brownish, highly reactive gas that is present in all urban environments. The major human-made sources of NO_2 are combustion devices, such as boilers, gas turbines, and mobile and stationary combustion engines. NO_2 forms quickly from emissions from cars, trucks and buses, power plants, and off-road equipment. In addition to contributing to the formation of ground-level ozone and fine particle pollution, NO_2 is linked with a number of adverse effects on the respiratory system (EPA 2010). The combined emissions of NO and NO_2 are referred to as NO_X, which are reported as equivalent NO_2. Because NO_2 is formed and depleted by reactions associated with ozone, the NO_2 concentration in a particular geographical area may not be representative of the local NO_X emission sources.

Sulfur Dioxide

SO_2 is produced by such stationary sources as coal and oil combustion, steel mills, refineries, and pulp and paper mills. SO_2 is a respiratory irritant. On contact with the moist mucous membranes, SO_2 produces sulfurous acid.

Particulate Matter

Respirable particulate matter with an aerodynamic diameter of 10 micrometers or less is referred to as PM_{10}. PM_{10} consists of particulate matter emitted directly into the air, such as fugitive dust, soot, and smoke from mobile and stationary sources, construction operations, fires, and natural windblown dust, and particulate matter formed in the atmosphere by condensation and/or transformation of SO_2 and ROG. $PM_{2.5}$ includes a subgroup of finer particles that have an aerodynamic diameter of 2.5 micrometers or less (EPA 2011a).

Lead

Lead is a metal found naturally in the environment and in manufactured products. The major sources of lead emissions have historically been mobile and industrial sources. As a result of the phase-out of leaded gasoline, metal processing is currently the primary source of lead emissions. The highest levels of lead in air are generally found near lead smelters. Other stationary sources are waste incinerators, utilities, and lead-acid battery manufacturers.

5.1.3 Monitoring Station Data and Criteria Pollutant Attainment Area Designations

Shasta Lake and Vicinity and Upper Sacramento River (Shasta Dam to Red Bluff)

Concentrations of criteria air pollutants are measured at several monitoring stations in Shasta County. The Redding Health Department and Shasta Lake stations are the closest stations to the project construction area with recent data for ozone and particulate matter. In general, the ambient air quality

measurements from these stations are representative of the study area's air quality. Table 5-1 summarizes the air quality data from the most recent 3 years.

Table 5-1. Summary of Annual Ambient Air Quality Data (2007–2009)

	2007	2008	2009
OZONE			
Redding Health Department Monitoring Station			
Maximum concentration (1-hour/8-hour average, ppm)	0.089/0.073	0.090/0.82	0.084/0.069
Number of days State 1-hour/8-hour standard exceeded	0/5	0/13	0/0
Number of days national 1-hour/8-hour standard exceeded	0/0	0/4	0/0
FINE PARTICULATE MATTER ($PM_{2.5}$)			
Redding Health Department Monitoring Station			
Maximum concentration ($\mu g/m^3$)	18.6	200.2	20.2
Number of days national standard exceeded (measured[a])	0	5	0
RESPIRABLE PARTICULATE MATTER (PM_{10})			
Redding Health Department Monitoring Station			
Maximum concentration ($\mu g/m^3$)	36.0	232.0	32.6
Number of days State standard exceeded (measured/calculated[a])	0/0	5/32.7	0/0
Number of days national standard exceeded (measured/calculated[a])	0/0	1/6.6	0/0
Shasta Lake Monitoring Station			
Maximum concentration ($\mu g/m^3$)	57.0	104.9	32.2
Number of days State standard exceeded (measured/calculated[a])	1/-	3/19.5	0/0
Number of days national standard exceeded (measured/calculated[a])	0/0	0/0	0/0

Source: ARB 2011

Note:

[a] Measured days are those days that an actual measurement was greater than the level of the State daily standard or the national daily standard. Measurements are typically collected every 6 days. Calculated days are the estimated number of days that a measurement would have been greater than the level of the standard had measurements been collected every day. The number of days above the standard is not necessarily the number of violations of the standard for the year.

Key:

* = insufficient data available to determine value.

$\mu g/m^3$ = micrograms per cubic meter

$PM_{2.5}$ = fine particulate matter with an aerodynamic diameter of 2.5 micrometers or less

PM_{10} = respirable particulate matter with an aerodynamic diameter of 10 micrometers or less

ppm = parts per million

The monitoring data are used to designate areas according to their attainment status for criteria air pollutants. The purpose of these designations is to identify those areas with air quality problems and thereby initiate planning efforts for improvement. The three basic designation categories are "nonattainment," "attainment," and "unclassified." "Unclassified" is used in an area that cannot be classified on the basis of available information as meeting or not meeting the standards. In addition, the California designations include a subcategory of the nonattainment designation, "nonattainment-transitional," that is given to nonattainment areas that are progressing and nearing attainment. The most current attainment designations for Shasta County are shown in Table 5-2 for each criteria air pollutant.

Lower Sacramento River and Delta

The lower Sacramento River and Delta areas are within the SVAB and the San Joaquin Valley Air Basin. As described in greater detail in the *Air Quality and Climate Technical Report*, these basins are Federal and State nonattainment areas for ozone, PM_{10}, and $PM_{2.5}$.

CVP/SWP Service Areas

The CVP and SWP service areas extend beyond the Central Valley into the San Francisco Bay Area, North Central Coast, South Central Coast, and Mountain Counties air basins. Federal and State ozone attainment designations for all California counties and air basins are provided in the *Air Quality and Climate Technical Report*. All counties in California south of Shasta County, with the exception of Lake, Sonoma, Tuolumne, and Mariposa counties, are State nonattainment areas for PM_{10} (ARB 2010a).

5.1.4 Toxic Air Contaminants in the Primary Study Area

TACs, or in Federal terms hazardous air pollutants (HAP), are air pollutants that may cause or contribute to an increase in mortality or in serious illness, or that may pose a hazard to human health. TACs are usually present in minute quantities in the ambient air; however, their high toxicity or health risk may pose a threat to public health even at low concentrations. Of the TACs for which data are available in California, diesel particulate matter (diesel PM), naturally occurring asbestos, benzene, 1,3-butadiene, acetaldehyde, carbon tetrachloride, hexavalent chromium, para-dichlorobenzene, formaldehyde, methylene chloride, and perchloroethylene pose the greatest known health risks. Dioxins are also considered to pose substantial health risk and diesel PM poses the greatest health risk. Current facilities permitted by SCAQMD in the project vicinity are Lehigh Southwest Cement Company, Mountain Gate Quarry, Knauf Insulation, and Sierra Pacific Industries.

Table 5-2. Ambient Air Quality Standards and Designations

Pollutant	Averaging Time	California		National Standards [a]		
		Standards [b,c]	Attainment Status (Shasta County) [d]	Primary [c,e]	Secondary [c,f]	Attainment Status (Shasta County) [g]
Ozone	1-hour	0.09 ppm (180 µg/m^3)	N (Moderate)	*Note h*	Same as primary standard	–
	8-hour	0.070 ppm	–	0.075 ppm (147 µg/m^3)		U/A
Carbon monoxide	1-hour	20 ppm (23 mg/m^3)	U	35 ppm (40 mg/m^3)	–	U/A
	8-hour	9 ppm (10 mg/m^3)		9 ppm (10 mg/m^3)		
	8-hour (Lake Tahoe)	6 ppm (7 mg/m^3)	–	–	–	–
Nitrogen dioxide (NO_2)	Annual Arithmetic Mean	0.030 ppm (57 µg/m^3)	–	0.053 ppm (100 µg/m^3) [i]	Same as primary standard	U/A
	1-hour	0.18 ppm (339 µg/m^3)	A	0.100 ppm (188 µg/m^3) [i]		–
Sulfur dioxide (SO_2)	24-hour	0.04 ppm (105 µg/m^3)	A	–	–	U
	3-hour	–	–	–	0.5 ppm (1300 µg/m^3) [j]	
	1-hour	0.25 ppm (655 µg/m^3)	A	0.075 ppm (196 µg/m^3) [j]	–	–
Respirable particulate matter (PM_{10})	Annual Arithmetic Mean	20 µg/m^3	N	–	Same as primary standard	U/A
	24-hour	50 µg/m^3		150 µg/m^3 [f]		
Fine particulate matter ($PM_{2.5}$)	Annual Arithmetic Mean	12 µg/m^3	U	15 µg/m^3	Same as primary standard	U/A
	24-hour	–	–	35 µg/m^3		
Lead [k]	30-day Average	1.5 µg/m^3	A	–	–	–
	Calendar Quarter	–		1.5 µg/m^3	Same as primary standard	A
	Rolling 3 Month Average	–		0.15 µg/m^3		
Sulfates	24-hour	25 µg/m^3	A	No national standards		
Hydrogen sulfide	1-hour	0.03 ppm (42 µg/m^3)	U			
Vinyl chloride [k]	24-hour	0.01 ppm (26 µg/m^3)	U/A			
Visibility-reducing particle matter	8-hour	Extinction coefficient of 0.23 per kilometer—visibility of 10 mi or more	U			

Table 5-2. Ambient Air Quality Standards and Designations (contd.)

Sources: ARB 2010a, 2010b; EPA 2011b; data compiled by AECOM in 2011

Notes:

[a] National standards (other than ozone, particulate matter, and those based on annual averages or annual arithmetic means) are not to be exceeded more than once a year. The ozone standard is attained when the fourth highest 8-hour concentration in a year, averaged over 3 years, is equal to or less than the standard. The PM10 24-hour standard is attained when 99 percent of the daily concentrations, averaged over 3 years, are equal to or less than the standard. The PM2.5 24-hour standard is attained when 98 percent of the daily concentrations, averaged over 3 years, are equal to or less than the standard. Contact the U.S. Environmental Protection Agency (EPA) for further clarification and current Federal policies.

[b] California standards for ozone, CO (except Lake Tahoe), SO_2 (1- and 24-hour), NO_2, particulate matter, and visibility-reducing particles are values that are not to be exceeded. All others are not to be equaled or exceeded. California ambient air quality standards are listed in the Table of Standards in Section 70200 of Title 17 of the California Code of Regulations.

[c] Concentration expressed first in units in which it was promulgated (i.e., parts per million (ppm) or micrograms per cubic meter ($\mu g/m^3$)). Equivalent units given in parentheses are based upon a reference temperature of 25 degrees Celsius (°C) and a reference pressure of 760 torr. Most measurements of air quality are to be corrected to a reference temperature of 25°C and a reference pressure of 760 torr; ppm in this table refers to ppm by volume, or micromoles of pollutant per mole of gas.

[d] Unclassified (U): A pollutant is designated unclassified if the data are incomplete and do not support a designation of attainment or nonattainment.

Attainment (A): A pollutant is designated attainment if the State standard for that pollutant was not violated at any site in the area during a 3-year period.

Nonattainment (N): A pollutant is designated nonattainment if there was a least one violation of a State standard for that pollutant in the area.

Nonattainment/Transitional (NT): A subcategory of the nonattainment designation. An area is designated nonattainment/transitional to signify that the area is close to attaining the standard for that pollutant.

[e] National Primary Standards: The levels of air quality necessary, with an adequate margin of safety, to protect the public health.

[f] National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.

[g] Nonattainment (N): Any area that does not meet (or that contributes to ambient air quality in a nearby area that does not meet) the national primary or secondary ambient air quality standard for the pollutant.

Attainment (A): Any area that meets the national primary or secondary ambient air quality standard for the pollutant.

Unclassifiable (U): Any area that cannot be classified on the basis of available information as meeting or not meeting the national primary or secondary ambient air quality standard for the pollutant.

[h] The 1-hour ozone national ambient air quality standard was revoked on June 15, 2005, for all areas in California.

[i] To attain this standard, the 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 0.100 part per million (ppm) (effective January 22, 2010). Note that the EPA standards are in units of parts per billion (ppb). California standards are in units of ppm. To directly compare the national standards to the California standards, the units can be converted from ppb to ppm. In this case, the national standards of 53 ppb and 100 ppb are identical to 0.053 ppm and 0.100 ppm, respectively.

[j] On June 2, 2010, EPA established a new 1-hour SO_2 standard, effective August 23, 2010, which is based on the 3-year average of the annual 99th percentile of 1-hour daily maximum concentrations. EPA also proposed a new automated Federal Reference Method (FRM) using ultraviolet technology, but will retain the older pararosaniline methods until the new FRM have adequately permeated State monitoring networks. EPA also revoked both the existing 24-hour SO_2 standard of 0.14 ppm and the annual primary SO_2 standard of 0.030 ppm, effective August 23, 2010.

The secondary SO_2 standard was not revised at that time; however, the secondary standard is undergoing a separate review by EPA. Note that the new standard is in ppb. California standards are in ppm. To directly compare the new primary national standard to the California standard the units can be converted to ppm. In this case, the national standard of 75 ppb is identical to 0.075 ppm.

[k] The California Air Resources Board has identified lead and vinyl chloride as toxic air contaminants with no threshold of exposure for adverse health effects determined. These actions allow for the implementation of control measures at levels below the ambient concentrations specified for these pollutants.

Key:

$\mu g/m^3$ = micrograms per cubic meter

mg/m^3 = milligrams per cubic meter

ppm = parts per million

5.1.5 Global Study Area

Atmospheric GHGs play a critical role in determining the earth's surface temperature. Solar radiation enters the earth's atmosphere from space. Prominent GHGs contributing to the greenhouse effect are carbon dioxide (CO_2), methane, nitrous oxide, hydrofluorocarbons, chlorofluorocarbons, and sulfur hexafluoride. Sources of GHG emissions associated with existing operations include vehicles used for operation and maintenance of the dam and recreation areas, vehicles used by recreational visitors, and fossil fuel–powered boats on Shasta Lake. Human-caused emissions of these GHGs that exceed natural ambient concentrations are responsible for intensifying the greenhouse effect and have led to a trend of unnatural warming of the earth's climate, known as global climate change or global warming (Ahrens 2003).

To provide a method of quantifying GHG emissions, the standard unit of CO_2e, or CO_2 equivalent, was developed. The definition of CO_2e is "The quantity of a given GHG multiplied by its total global warming potential (GWP). This is the standard unit for comparing the degree of warming that can be caused by GHGs" (CCAR 2009). The GWP of a GHG is dependent on the lifetime, or persistence, of the gas molecule in the atmosphere compared to CO_2. The GWP of methane is 23; the GWP of nitrous oxide is 296. Therefore, methane and nitrous oxide are more potent GHGs than CO_2. Expressing emissions in CO_2e takes the contributions of all GHG emissions to the greenhouse effect and converts them to a single unit equivalent to the effect that would occur if only CO_2 were being emitted. The most common quantity unit for CO_2e is million metric tons (MMT). In some reports, CO_2e is written as CO_2E, and million metric tons is written as MMT CO_2E.

Climate change is a global phenomenon. GHGs are global pollutants, unlike criteria air pollutants and TACs, which are pollutants of regional and local concern. Whereas pollutants with localized air quality effects have relatively short atmospheric lifetimes (about 1 day), GHGs have long atmospheric lifetimes (1 year to several thousand years). GHGs persist in the atmosphere for long enough time periods to be dispersed around the globe. Although the exact lifetime of any particular GHG molecule is dependent on multiple variables and cannot be pinpointed, it is understood that more CO_2 is emitted into the atmosphere than is sequestered by ocean uptake, vegetation, and other forms of sequestration. Of the total annual human-caused CO_2 emissions, approximately 54 percent is sequestered through ocean uptake, uptake by Northern Hemisphere forest regrowth, and other terrestrial sinks within a year, whereas the remaining 46 percent of human-caused CO_2 emissions remains stored in the atmosphere (Seinfeld and Pandis 1998).

Effects of GHGs are borne globally, as opposed to localized air quality effects of criteria air pollutants and TACs. The quantity of GHGs that it takes to ultimately result in climate change is not precisely known; suffice it to say that the quantity is enormous, and no single project alone would be expected to measurably contribute to a noticeable incremental change in the global average temperature,

or to global, local, or micro climate. From the standpoint of CEQA, GHG effects related to global climate change are inherently cumulative.

Please see the *Air Quality and Climate Technical Report* for a discussion of GHG feedback mechanisms and uncertainty.

5.2 Regulatory Framework

Air quality in Shasta County is regulated by such agencies as the U.S. Environmental Protection Agency (EPA), the California Air Resources Board (ARB), and SCAQMD. Each of these agencies develops rules, regulations, policies, and/or goals to comply with applicable legislation. Although EPA regulations may not be superseded, both State and local regulations may be more stringent.

5.2.1 Federal

Criteria Air Pollutants

At the Federal level, EPA implements national air quality programs. EPA's air quality mandates are drawn primarily from the Federal Clean Air Act (CAA), which was enacted in 1970 and most recently amended in 1990.

The CAA required EPA to establish primary and secondary national ambient air quality standards, as shown in Table 5-2. The CAA also required each state to prepare an air quality control plan referred to as a State implementation plan (SIP). The Federal Clean Air Act Amendments of 1990 (CAAA) added requirements for states with nonattainment areas to revise their SIPs to incorporate additional control measures to reduce air pollution. The SIP is modified periodically to reflect the latest emissions inventories, planning documents, and rules and regulations of the air basins as reported by their jurisdictional agencies. EPA reviews all SIPs to determine whether they conform to the mandates of CAA and its amendments, and whether implementation will achieve air quality goals. If EPA determines a SIP to be inadequate, a Federal implementation plan that imposes additional control measures may be prepared for the nonattainment area. Failure to submit an approvable SIP or to implement the plan within the mandated time frame may result in the application of sanctions to transportation funding and stationary air pollution sources in the air basin.

Hazardous Air Pollutants

Air quality regulations also focus on TACs, or in Federal parlance, HAPs. In general, for those TACs that may cause cancer, there is no concentration that does not present some risk. In other words, there is no threshold level below which adverse health effects may not be expected to occur. This contrasts with the criteria air pollutants, for which acceptable levels of exposure can be determined and for which the ambient standards have been established (Table

5-2). Instead, EPA and ARB regulate HAPs and TACs, respectively, through statutes and regulations that generally require the use of the maximum available control technology or best available control technology for toxics to limit emissions. These statutes and regulations establish the regulatory framework for TACs.

EPA has programs for identifying and regulating HAPs. Title III of the CAAA directed EPA to promulgate national emissions standards for HAPs. National emissions standards for HAPs vary depending on the pollutant source type. The national emissions standards for HAPs for major stationary sources of HAPs could therefore be different than those for area sources. Major sources are defined as stationary sources with potential to emit more than 10 tons per year of any HAP or more than 25 tons per year of any combination of HAPs; all other sources are considered area sources. The emissions standards were to be promulgated in two phases. In the first phase (1992 to 2000), EPA developed technology-based emission standards designed to produce the maximum emission reduction achievable. These standards are generally referred to as requiring maximum available control technology. For area sources, the standards may be different, based on generally available control technology. In the second phase (2001 to 2008), EPA was required to promulgate health risk–based emissions standards, where deemed necessary, to address risks remaining after implementation of the technology-based national emission standards for HAPs standards.

The CAAA also required EPA to promulgate vehicle or fuel standards containing reasonable requirements that control toxic emissions of benzene and formaldehyde at a minimum. Performance criteria were established to limit mobile-source emissions of toxics, including benzene, formaldehyde, and 1,3-butadiene. In addition, Section 219 required the use of reformulated gasoline in selected areas with the most severe ozone nonattainment conditions to further reduce mobile-source emissions.

General Conformity

The 1990 amendments to CAA Section 176 require EPA to promulgate rules to ensure that Federal actions conform to the appropriate SIP. These rules are known as the General Conformity Rule (40 Code of Federal Regulations Parts 51.850–51.860 and 93.150–93.160). Any Federal agency responsible for an action in a nonattainment/maintenance area must determine whether that action conforms to the applicable SIP or is exempt from General Conformity Rule requirements.

Shasta County, where the proposed action would occur, is neither a nonattainment area nor a maintenance area for the national ambient air quality standards. Therefore, the General Conformity Rule is not applicable to the project.

Greenhouse Gases

Mandatory Greenhouse Gas Reporting Rule On September 22, 2009, EPA released its final Greenhouse Gas Reporting Rule (Reporting Rule). The Reporting Rule is a response to the fiscal year 2008 Consolidated Appropriations Act (House Bill 2764; Public Law 110-161), which required EPA to develop "… mandatory reporting of greenhouse gases above appropriate thresholds in all sectors of the economy…." The Reporting Rule applies to most entities that emit 25,000 metric tons (MT) CO_2e or more per year. Since 2010, facility owners have been required to submit an annual GHG emissions report with detailed calculations of facility GHG emissions. The Reporting Rule also mandates recordkeeping and administrative requirements for EPA to verify annual GHG emissions reports.

U.S. Environmental Protection Agency Endangerment and Cause or Contribute Findings On December 7, 2009, the EPA Administrator signed two distinct findings regarding GHGs under Section 202(a) of the CAA:

- **Endangerment Finding** – The current and projected concentrations of the six key well-mixed GHGs – CO_2, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride – in the atmosphere threaten the public health and welfare of current and future generations.

- **Cause or Contribute Finding** – The combined emissions of these well-mixed GHGs from new motor vehicles and new motor vehicle engines contribute to GHG pollution, which threatens public health and welfare.

Council on Environmental Quality Draft NEPA Guidelines Because of uneven treatment of climate change under NEPA, the International Center for Technology Assessment, Natural Resources Defense Council, and Sierra Club filed a petition with the Council on Environmental Quality (CEQ) in March 2008. The petition requested that climate change analyses be included in all Federal environmental review documents. In October 2009, President Barack Obama signed Executive Order 13514, "Federal Leadership in Environmental, Energy, and Economic Performance." The goal of this executive order is "to establish an integrated strategy towards sustainability in the Federal Government and to make reduction of greenhouse gas emissions (GHG) a priority for Federal agencies" (FedCenter 2011).

In response to the petition and subsequent Executive Order 13514, CEQ issued guidance on including GHG emissions and climate change impacts in environmental review documents under NEPA. CEQ's guidance (issued February 18, 2010) suggests that Federal agencies consider opportunities to reduce GHG emissions caused by proposed Federal actions, adapt their actions to climate change impacts throughout the NEPA process, and address these issues in the agencies' NEPA procedures. The following are the two main

factors to consider when addressing climate change in environmental documentation:

- The effects of a proposed action and alternative actions on GHG emissions
- The impacts of climate change on a proposed action or alternatives

CEQ notes that "significant" national policy decisions with "substantial" GHG impacts require analysis of their GHG effects. That is, the GHG effects of a Federal agency's proposed action must be analyzed if the action would cause "substantial" annual direct emissions; would implicate energy conservation or reduced energy use or GHG emissions; or would promote cleaner, more efficient renewable-energy technologies. Qualitative or quantitative information on GHG emissions that is useful and relevant to the decision should be used when deciding among alternatives.

CEQ states that if a proposed action would cause direct annual emissions of more than 25,000 MT CO_2e, a quantitative and qualitative assessment may be meaningful to decision makers and the public. If annual direct emissions would be less than 25,000 MT CO_2e, Federal agencies are encouraged to consider whether the action's long-term emissions should receive similar analysis.

5.2.2 State

ARB coordinates and oversees State and local air pollution control programs in California and implements the California Clean Air Act (CCAA).

Criteria Air Pollutants

The CCAA, which was adopted in 1988, required ARB to establish California ambient air quality standards (Table 5-2). The CCAA requires that all local air districts in the state endeavor to achieve and maintain California ambient air quality standards by the earliest practical date. The act specifies that local air districts should particularly focus on reducing emissions from transportation and areawide sources, and authorizes districts to regulate indirect sources. Among ARB's other responsibilities are to oversee local air district compliance with California and Federal laws; approve local air quality plans; submit SIPs to EPA; monitor air quality; determine and update area designations and maps; and set emissions standards for new mobile sources, consumer products, small utility engines, off-road vehicles, and fuels.

Toxic Air Contaminants

TACs in California are regulated primarily through the Tanner Air Toxics Act (Assembly Bill (AB) 1807 (Statutes of 1983)) and the Air Toxics Hot Spots Information and Assessment Act (AB 2588 (Statutes of 1987)). AB 1807 sets forth a formal procedure for ARB to designate substances as TACs. Research, public participation, and scientific peer review must be completed before ARB can designate a substance as a TAC. To date, ARB has identified more than 21

TACs and has adopted EPA's list of HAPs as TACs. Most recently, diesel PM was added to the ARB list of TACs.

Once a TAC is identified, ARB adopts an airborne toxics control measure for sources that emit that particular TAC. If a safe threshold exists for a substance at which there is no toxic effect, the control measure must reduce exposure below that threshold. If there is no safe threshold, the measure must incorporate best available control technology to minimize emissions.

AB 2588 requires facilities that emit toxic substances above a specified level to do all of the following:

- Prepare a toxic emissions inventory
- Prepare a risk assessment if emissions are significant
- Notify the public of significant risk levels
- Prepare and implement risk reduction measures

Greenhouse Gases

Various statewide initiatives to reduce California's contribution to GHG emissions have raised awareness that, even though the various contributors to and consequences of global climate change are not yet fully understood, global climate change is under way, and real potential exists for severe adverse environmental, social, and economic effects in the long term. The most relevant laws and orders are discussed in more detail below.

California Environmental Quality Act and SB 97 CEQA requires lead agencies to consider the reasonably foreseeable adverse environmental effects of projects they are considering for approval. GHG emissions have the potential to adversely affect the environment because they contribute to global climate change. In turn, global climate change has the potential to raise sea levels, affect rainfall and snowfall, and affect habitat.

Senate Bill 97 Senate Bill (SB) 97 was enacted in August 2007 as part of the State budget negotiations and is codified at Section 21083.05 of the California Public Resources Code. SB 97 directs the Governor's Office of Planning and Research (OPR) to propose guidance in the State CEQA Guidelines "for the mitigation of GHG emissions or the effects of GHG emissions." SB 97 directed OPR to develop text for the State CEQA Guidelines by July 2009. This legislation also directed the State Resources Agency (now Natural Resources Agency) – the agency charged with adopting the State CEQA Guidelines – to certify and adopt such guidelines by January 2010. In April 2009, OPR prepared draft CEQA Guidelines amendments and submitted them to the Natural Resources Agency (see below). On July 3, 2009, the Natural Resources Agency began the rulemaking process established under the Administrative Procedure Act.

The Natural Resources Agency recommended amendments for GHGs to fit within the existing CEQA framework for environmental analysis, which calls for lead agencies to determine baseline conditions and levels of significance and evaluate mitigation measures. The amendments to the State CEQA Guidelines do not identify a threshold of significance for GHG emissions, nor do they prescribe assessment methodologies or specific mitigation measures. The amendments encourage lead agencies to consider many factors in performing a CEQA analysis, but preserve the discretion that CEQA grants lead agencies to make their own determinations based on substantial evidence.

Section 15064.4, "Determining the Significance of Impacts from Greenhouse Gas Emissions," of the State CEQA Guidelines encourages lead agencies to consider three factors to assess the significance of GHG emissions:

(1) Will the project increase or reduce GHGs as compared to the baseline?

(2) Will the project's GHG emissions exceed the lead agency's threshold of significance?

(3) Does the project comply with regulations or requirements to implement a statewide, regional, or local GHG reduction or mitigation plan?

These questions are addressed in Section 5.3.

Section 15064.4 also recommends that lead agencies make a good-faith effort, based on available information, to describe, calculate, or estimate the amount of GHG emissions associated with a project.

Section 15126.4, "Consideration and Discussion of Mitigation Measures Proposed to Minimize Significant Effects," of the State CEQA Guidelines lists considerations for lead agencies related to feasible mitigation measures to reduce GHG emissions. Among those considerations are the following:

- Project features, project design, or other measures that are incorporated into the project to substantially reduce energy consumption or GHG emissions

- Compliance with the requirements in a previously approved plan or mitigation program to reduce or sequester GHG emissions, when the plan or program provides specific requirements that will avoid or substantially lessen the potential impacts of the project

- Measures that sequester carbon or carbon-equivalent emissions

Section 15126.4 also specifies that where mitigation measures are proposed to reduce GHG emissions through off-site actions or purchase of carbon offsets, these mitigation measures must be part of a reasonable plan of mitigation that the relevant agency commits itself to implementing.

In addition, as part of the amendments and additions to the State CEQA Guidelines, a new set of environmental checklist questions (VII. Greenhouse Gas Emissions) was added to Appendix G of the State CEQA Guidelines. The new set asks whether a project would do either of the following:

a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?

b) Conflict with any applicable plan, policy or regulation of an agency adopted for the purpose of reducing the emissions of greenhouse gases?

Preliminary Draft Staff Proposal: Recommended Approaches for Setting Interim Significance Thresholds for Greenhouse Gases under CEQA CEQA gives discretion to lead agencies to establish thresholds of significance based on individual circumstances. To assist in that exercise, and because OPR believes the unique nature of GHGs warrants investigation of a statewide threshold of significance for GHG emissions, OPR asked ARB technical staff to recommend a methodology for setting thresholds of significance. In October 2008, ARB released *Preliminary Draft Staff Proposal: Recommended Approaches for Setting Interim Significance Thresholds for Greenhouse Gases under the California Environmental Quality Act* (ARB 2008). This draft proposal included a conceptual approach for thresholds associated with industrial, commercial, and residential projects. For nonindustrial projects, the steps to presuming a less than significant climate change impact generally involve analyzing whether the project meets the following criteria (ARB 2008):

- Is exempt under existing statutory or categorical exemptions
- Complies with a previously approved plan or target
- Meets specified minimum performance standards
- Falls below an as-yet-unspecified annual emissions level

The performance standards focus on construction activities, energy and water consumption, generation of solid waste, and transportation. For industrial projects, the draft proposal recommends a tiered analysis procedure similar to the procedure for analyzing nonindustrial projects. However, for industrial projects a quantitative limit for less than significant impacts is established at approximately 7,000 MT CO_2e per year. These standards have not yet been adopted or finalized as a basis for evaluating the significance of a project's contribution to climate change.

Executive Order S-3-05 Executive Order S-3-05 made California the first state to formally establish GHG emissions reduction goals. Executive Order S-3-05 includes the following GHG emissions reduction targets for California:

- By 2010, reduce GHG emissions to 2000 levels.

- By 2020, reduce GHG emissions to 1990 levels.
- By 2050, reduce GHG emissions to 80 percent below 1990 levels.

The final emission target of 80 percent below 1990 levels would put the state's emissions in line with estimates of the required worldwide reductions needed to bring about long-term climate stabilization and avoidance of the most severe impacts of climate change (IPCC 2007).

Executive Order S-3-05 also dictated that the Secretary of the California Environmental Protection Agency coordinate oversight of efforts to meet these targets with all of the following:

- The Secretaries of the Business, Transportation, and Housing Agency; California Department of Food and Agriculture; and California Natural Resources Agency
- The Chairpersons of ARB and the California Energy Commission
- The President of the California Public Utilities Commission

This group was subsequently named the Climate Action Team.

As laid out in Executive Order S-3-05, the Climate Action Team has submitted biannual reports to the Governor and State legislature describing progress made toward reaching the targets. The Climate Action Team is finalizing its second biannual report on the effects of climate change on California's resources.

Assembly Bill 32 In 2006, California passed the California Global Warming Solutions Act of 2006 (AB 32; California Health and Safety Code, Sections 38500 et seq.). AB 32 further details and puts into law the midterm GHG reduction target established in Executive Order S-3-05 – reduce GHG emissions to 1990 levels by 2020. AB 32 also identifies ARB as the State agency responsible for the design and implementation of emissions limits, regulations, and other measures to meet the target.

The statute lays out the schedule for each step of the regulatory development and implementation, as follows:

- By June 30, 2007, ARB had to publish a list of early-action GHG emission reduction measures.
- Before January 1, 2008, ARB had to identify the current level of GHG emissions by requiring statewide reporting and verification of GHG emissions from emitters and identify the 1990 levels of California GHG emissions.

- By January 1, 2010, ARB had to adopt regulations to implement the early-action measures.

In December 2007, ARB approved the 2020 GHG emission limit (1990 level) of 427 MMT CO_2e. The 2020 target requires the reduction of 169 MMT CO_2e, or approximately 30 percent below California's projected "business-as-usual" 2020 emissions of 596 MMT CO_2e.

Also in December 2007, ARB adopted mandatory reporting and verification regulations pursuant to AB 32. The regulations became effective January 1, 2009, with the first reports covering 2008 emissions. The mandatory reporting regulations require reporting for major facilities, those that generate more than 25,000 MT CO_2e per year. To date ARB has met all of the statutorily mandated deadlines for promulgation and adoption of regulations.

Climate Change Scoping Plan On December 11, 2008, pursuant to AB 32, ARB adopted the *Climate Change Scoping Plan*. This plan outlines how emissions reductions will be achieved from significant sources of GHGs via regulations, market mechanisms, and other actions. Six key elements, outlined in the scoping plan, are identified below to achieve emissions reduction targets:

- Expand and strengthen existing energy efficiency programs and building and appliance standards.

- Achieve a statewide renewable energy mix of 33 percent.

- Develop a California cap-and-trade program that links with other Western Climate Initiative partner programs to create a regional market system.

- Establish targets for transportation-related GHG emissions for regions throughout California, and pursue policies and incentives to achieve those targets.

- Adopt and implement measures pursuant to existing State laws and policies, including California's clean car standards, goods movement measures, and the Low Carbon Fuel Standard.

- Create targeted fees, including a public goods charge on water use, fees on high-GWP gases, and a fee to fund the administrative costs of the State's long-term commitment to AB 32 implementation.

The *Climate Change Scoping Plan* also recommended 39 measures that were developed to reduce GHG emissions from key sources and activities while improving public health, promoting a cleaner environment, preserving natural resources, and ensuring that the impacts of the reductions would be equitable and avoid disproportionately affecting low-income and minority communities.

These measures also put California on a path to meet the long-term 2050 goal of reducing statewide GHG emissions to 80 percent below 1990 levels. The measures in the approved scoping plan are being developed and will be in place by 2012.

Executive Order S-13-08 Executive Order S-13-08, issued November 14, 2008, directs the California Natural Resources Agency, DWR, OPR, the California Energy Commission, the State Water Resources Control Board, the California Department of Parks and Recreation, and California's coastal management agencies to participate in planning and research activities to advance California's ability to adapt to the effects of climate change. The order specifically directs agencies to work with the National Academy of Sciences to initiate the first California sea-level-rise assessment and to review and update the assessment every 2 years after completion; immediately assess the vulnerability of California's transportation system to sea level rise; and to develop a climate change adaptation strategy for California.

California Climate Change Adaptation Strategy Developed through cooperation and partnership among multiple State agencies, the 2009 *California Climate Adaptation Strategy* summarizes the best known science on climate change effects. The strategy describes effects of climate change on seven specific sectors—public health, biodiversity and habitat, ocean and coastal resources, water management, agriculture, forestry, and transportation and energy infrastructure—and recommends ways to manage against those threats.

Governor's Office of Planning and Research Technical Advisory In June 2008, OPR published a technical advisory on CEQA and climate change to provide interim advice to lead agencies regarding the analysis of GHGs in environmental documents (OPR 2008). The advisory encourages lead agencies to identify and quantify the GHGs that could result from a proposed project, analyze impacts of those emissions to determine whether they would be significant, and identify feasible mitigation measures or alternatives that would reduce adverse impacts to a less than significant level. The advisory recognized that OPR would develop, and the Natural Resources Agency would adopt, amendments to the State CEQA Guidelines pursuant to SB 97. (See "California Environmental Quality Act and SB 97," above.)

The advisory provides OPR's perspective on the emerging role of CEQA in addressing climate change and GHG emissions. It recognizes that approaches and methodologies for calculating GHG emissions and determining their significance are rapidly evolving. OPR concludes in the technical advisory that climate change is ultimately a cumulative impact, and that no individual project could have a significant impact on global climate. Thus, projects must be analyzed with respect to the incremental impact of the project when added to other past, present, and reasonably foreseeable probable future projects. OPR recommends that lead agencies undertake an analysis, consistent with available

guidance and current CEQA practice, to determine cumulative significance (OPR 2008).

The technical advisory points out that neither CEQA nor the State CEQA Guidelines prescribe thresholds of significance or particular methodologies for performing an impact analysis. "This is left to lead agency judgment and discretion, based upon factual data and guidance from regulatory agencies and other sources where available and applicable" (OPR 2008). OPR states that "the global nature of climate change warrants investigation of a statewide threshold of significance for GHG emissions" (OPR 2008). Until such a standard is established, OPR advises that each lead agency should develop its own approach to performing an analysis for projects that generate GHG emissions (OPR 2008).

OPR sets out the following process for evaluating GHG emissions. First, agencies should determine whether GHG emissions may be generated by a proposed project, and if so, quantify or estimate the emissions by type or source. Calculation, modeling, or estimation of GHG emissions should include the emissions associated with vehicular traffic, energy consumption, water usage, and construction activities (OPR 2008).

Agencies should then assess whether the emissions are "cumulatively considerable" even though a project's GHG emissions may be individually limited. OPR states: "Although climate change is ultimately a cumulative impact, not every individual project that emits GHGs must necessarily be found to contribute to a significant cumulative impact on the environment" (OPR 2008). Individual lead agencies may undertake a project-by-project analysis, consistent with available guidance and current CEQA practice (OPR 2008).

Finally, if the lead agency determines that emissions are a cumulatively considerable contribution to a significant cumulative impact, the lead agency must investigate and implement ways to mitigate the emissions (OPR 2008). OPR (2008) states:

> *Mitigation measures will vary with the type of project being contemplated, but may include alternative project designs or locations that conserve energy and water, measures that reduce vehicle miles traveled by fossil-fueled vehicles, measures that contribute to established regional or programmatic mitigation strategies, and measures that sequester carbon to offset the emissions from the project.*

OPR concludes that "A lead agency is not responsible for wholly eliminating all GHG emissions from a project; the CEQA standard is to mitigate to a level that is "less than significant" (OPR 2008). Attachment 3 to the technical advisory includes a list of GHG reduction measures that can be applied on a project-by-project basis.

California Air Pollution Officers Association In January 2008, the California Air Pollution Control Officers Association issued a "white paper" on evaluating and addressing GHGs under CEQA (CAPCOA 2008). This resource guide was prepared to support local governments as they develop their climate change programs and policies. Though not a guidance document, the paper provides information about key elements of CEQA GHG analyses, including a survey of different approaches to setting quantitative significance thresholds. The following are some of the thresholds discussed:

- Zero (all emissions are significant)
- 900 MT CO_2e per year (90 percent market capture for residential and nonresidential discretionary development)
- 10,000 MT CO_2e per year (potential ARB mandatory reporting level for cap-and-trade program)
- 25,000 MT CO_2e per year (ARB's mandatory reporting level for the statewide emissions inventory)
- Unit-based thresholds, based on identifying thresholds for each type of new development and quantifying significance by a 90 percent capture rate

5.2.3 Regional and Local

Shasta Lake and Vicinity and Upper Sacramento River (Shasta Dam to Red Bluff)

Shasta County Air Quality Management District SCAQMD is the primary local agency regulating air quality for all of Shasta County. SCAQMD attains and maintains air quality conditions in Shasta County through a comprehensive program of planning, regulation, enforcement, technical innovation, and promotion of the understanding of air quality issues. The clean-air strategy of SCAQMD is to prepare plans and programs for the attainment of ambient air quality standards, adopt and enforce rules and regulations, and issue permits for stationary sources. SCAQMD also inspects stationary sources, responds to citizen complaints, monitors ambient air quality and meteorological conditions, and implements other programs and regulations required by the CAA, CAAA, and CCAA.

Rules and Regulations All projects in Shasta County are subject to SCAQMD rules and regulations in effect at the time of construction. Specific rules applicable to the project may include the following:

- **Rule 2:1A: Permits Required** – Any person who is building, erecting, altering, or replacing any article, machine, equipment or other contrivance, or multicomponent system including same, portable or

stationary and who is not exempt under Section 42310 of the California Health and Safety Code, the use of which may cause the issuance of air contaminants, shall first obtain written authority for such construction from the Air Pollution Control Officer.

- **Rule 2:7: Conditions for Open Burning** – All material to be burned must be arranged so that it will burn with a minimum of smoke and must be reasonably free of dirt, soil, and visible surface moisture. All vegetative wastes to be burned shall be ignited only with approved ignition devices and shall be free of tires, illegal residential waste, tar paper, construction debris, and combustible and flammable waste. No burning shall cause emissions to be transported into smoke sensitive areas. No burning shall be conducted when such burns, in conjunction with present or predicted meteorology, could cause or contribute to a violation of an ambient air quality standard.

- **Rule 3:15: Cutback and Emulsified Asphalt** – A person shall not manufacture, sell, offer for sale, use, or apply for paving, construction, or maintenance of parking lots, driveways, streets, or highways any rapid- or medium-cure cutback asphalt, slow-cure cutback asphalt material that contains more than 0.5 percent by volume VOCs that boil at 500 degrees Fahrenheit (°F) (260 degrees Celsius) (°C) or less, or any emulsified asphalt material that contains more than 3.0 percent by volume of VOCs that evaporate at 500°F (260°C) or less.

- **Rule 3:16: Fugitive, Indirect, or Nontraditional Sources** – The Air Pollution Control Officer may place reasonable conditions upon any source, as delineated below, that will mitigate the emissions from such sources to below a level of significance or to a point that such emissions no longer constitute a violation of Health and Safety Code Sections 41700 and/or 41701: fugitive sources, indirect sources, and nontraditional sources.

- **Rule 3:22: Asbestos** – No person shall use or apply serpentine material for surfacing in California unless the material has been tested using ARB Test Method 435 and determined to have an asbestos content of 5 percent or less. A written receipt or other record documenting the asbestos content shall be retained by any person who uses or applies serpentine material for at least 7 years from the date of use or application, and shall be provided to the Air Pollution Control Officer, or his or her designate, for review upon request.

- **Rule 3:31: Architectural Coatings** – The developer or contractor is required to use coatings that comply with the VOC content limits specified in the rule.

Criteria Pollutants SCAQMD has adopted pollutant emission thresholds and mitigation requirements that are used in the analysis of project impacts. The thresholds and mitigation requirements are discussed below in Section 5.3.2, "Criteria for Determining Significance of Effects."

Attainment Plan Air quality planning in the NSVAB has been undertaken on a joint basis by the air districts in seven counties. The current plan, the *Northern Sacramento Valley Planning Area 2009 Triennial Air Quality Attainment Plan* (AQAP), is an update of plans prepared in 1994, 1997, 2000, 2003, and 2006. The purpose of the plan is to achieve and maintain healthful air quality throughout the air basin. The 2009 AQAP addresses the progress made in implementing the 2006 plan and proposes modifications to the strategies necessary to attain the California ambient air quality standards for the 1-hour ozone standard at the earliest practicable date.

The AQAP is based on each county's projected emission inventory, which includes stationary, areawide, and mobile sources. Emission inventories are based on general plans and anticipated development.

Toxic Air Contaminants At the local level, air pollution control or management districts may adopt and enforce ARB control measures. Under SCAQMD Rule V, "Additional Procedures For Issuing Permits To Operate For Sources Subject To Title V Of The Federal Clean Air Act Amendments Of 1990," Rule 2:1, "New Source Review," and Rule 2:1A, "Permits Required," all sources that possess the potential to emit TACs are required to obtain permits from the district. Permits may be granted to these operations if they are constructed and operated in accordance with applicable regulations, including new-source-review standards and air-toxics control measures. SCAQMD limits emissions and public exposure to TACs through a number of programs. SCAQMD prioritizes TAC-emitting stationary sources based on the quantity and toxicity of the TAC emissions and the proximity of the facilities to sensitive receptors.

Shasta County General Plan The Air Quality Element of the *Shasta County General Plan* (Shasta County 2004) contains objectives and policies aimed at protecting and improving Shasta County's air quality, meeting the requirements of the Federal CAA and CCAA, and integrating planning efforts (e.g., transit, land use) to reduce air pollution contaminants, among others.

Tehama County Air Pollution Control District The southern portion of the primary study area is in Tehama County. The Tehama County Air Pollution Control District is the primary local agency with respect to air quality for Tehama County. The Tehama County Air Pollution Control District has rules and regulations similar to those described for SCAQMD. The Tehama County Air Pollution Control District is in the NSVAB and is therefore a participant in NSVAB's 2003 AQAP.

Lower Sacramento River and Delta and CVP/SWP Service Areas

All areas of California are within the jurisdiction of an air pollution control district or an air quality management district. Each district has rules and regulations similar to those described above for SCAQMD. Districts that are classified as nonattainment for one or more criteria pollutants have attainment plans or similar documents as required by ARB. Most districts have guidance documents for the analysis of air quality impacts for CEQA compliance.

Global Study Area—Greenhouse Gases

There are no regional or local policies, regulations, or laws pertaining to GHG emissions.

5.3 Environmental Consequences and Mitigation Measures

5.3.1 Methods and Assumptions

Criteria Air Pollutants

The proposed SLWRI alternatives are quite complex. They consist of implementing construction activities for the dam structure; clearing the reservoir area that would be affected by the increase in pool height; relocating and modifying bridges, roads, utilities, and recreation areas; and completing other related tasks. At the current stage of project development (April 2011), project planning, design, and engineering is preliminary. Detailed development of construction plans and schedule is not anticipated until an alternative is selected and approved. However, potential air quality impacts from emissions of criteria pollutants may be assessed quantitatively by estimating emissions for major project elements and understanding the implications of additional emissions from project activities that are not quantified.

The URBEMIS2007 emissions model was used to generate estimates of construction activity emissions. The URBEMIS2007 software package, Version 9.2.4, is a calculation tool designed to estimate air pollutant emissions from land use development projects based on development type and size. The emissions factors and calculation methodologies contained in the URBEMIS2007 program were developed in cooperation with ARB and many air districts in California. Among the inputs to the model for construction analysis are the following:

- Types and quantities of construction equipment to be used and hours of use
- Areas of land to be graded
- Number of truck trips and trip distances for export of spoils and import of materials
- Volumes of buildings to be demolished

- Areas of buildings to be built
- Areas of land to be paved

Attachment 1 of the *Air Quality and Climate Technical Report* contains the worksheets generated by URBEMIS2007 documenting the input and output for this analysis.

The Sacramento Metropolitan Air Quality Management District's Road Construction Emissions Model, version 6.3.2, was used to estimate emissions from the Reading Island portion of the project proposed under CP4 and CP5. This model is used for linear projects, such as Reading Island, and uses emission factors from EMFAC2007 and OFFROAD2007 databases developed by ARB. Inputs in the Road Construction Emissions Model include construction equipment populations, material and soil hauling, and construction phase timelines.

For postconstruction activities, principal inputs are the number of vehicle trips and average trip distances. Attachment 1 of the *Air Quality and Climate Technical Report* contains the worksheets generated by the model URBEMIS2007 documenting the input and output for this analysis.

SCAQMD and the Tehama County Air Pollution Control District standards are discussed relative to impact thresholds.

Toxic Air Contaminants and Odors

TACs and odors are discussed in accordance with SCAQMD, ARB, and EPA policies and rules.

Global Warming

Emissions of CO_2 from construction activities and from recreational visitors' vehicles were calculated using the URBEMIS2007 program. Data on CO_2 emissions avoided by generation of electricity from Shasta Dam were obtained from Chapter 5 of the *Shasta Lake Water Resources Investigation Plan Formulation Report* (Reclamation 2007). Emissions of CO_2 from cleared and burned vegetation were estimated using the Carbon Online Estimator (COLE Development Group 2011). Indirect emissions from cement production and CO_2 absorption by water and vegetation are discussed but not quantified.

5.3.2 Criteria for Determining Significance of Effects

An environmental document prepared to comply with NEPA must consider the context and intensity of the environmental effects that would be caused by, or result from, the proposed action. Under NEPA, the significance of an effect is used solely to determine whether an environmental impact statement must be prepared. An environmental document prepared to comply with CEQA must identify the potentially significant environmental effects of a proposed project. A "[s]ignificant effect on the environment" means a substantial, or potentially

substantial, adverse change in any of the physical conditions within the area affected by the project" (State CEQA Guidelines, Section 15382). CEQA also requires that the environmental document propose feasible measures to avoid or substantially reduce significant environmental effects (State CEQA Guidelines, Section 15126.4(a)).

The following significance criteria were developed based on guidance provided by the State CEQA Guidelines, and consider the context and intensity of the environmental effects as required under NEPA. Impacts of an alternative on air quality and climate would be significant if project implementation would do any of the following:

- Conflict with or obstruct implementation of the applicable air quality plan
- Violate any air quality standard or contribute substantially to an existing or projected air quality violation
- Result in a cumulatively considerable net increase of a criteria air pollutant for which the project region is nonattainment under any applicable Federal or State ambient air quality standard (including releasing emissions that exceed quantitative thresholds for ozone precursors)
- Expose sensitive receptors to substantial pollutant concentrations
- Create objectionable odors affecting a substantial number or people
- Generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment
- Conflict with any applicable plan, policy, or regulation of an agency adopted for the purpose of reducing the emissions of GHGs

As stated in Appendix G of the State CEQA Guidelines, the significance criteria established by the applicable air quality management or air pollution control district may be relied upon to make the above determinations. SCAQMD has adopted air quality thresholds (Table 5-3). These thresholds are based on SCAQMD New Source Review Rule 2:1. The thresholds and policy are published in the *Shasta County General Plan*.

Table 5-3. Shasta County Air Quality Management District's Air Quality Emission Thresholds

NO_X	ROG	PM_{10}	CO
Level A Thresholds			
25 lb/day	25 lb/day	80 lb/day	500 lb/day
Level B Thresholds			
137 lb/day	137 lb/day	137 lb/day	500 lb/day

Source: Shasta County 2004

Note:
These thresholds will be applied during the Shasta County Planning Division's CEQA review process. The CO thresholds do not appear in the general plan, but are included in SCAQMD policy.

Key:
CEQA = California Environmental Quality Act
CO = carbon monoxide
lb/day = pounds per day
NO_X = oxides of nitrogen
PM_{10} = respirable particulate matter
ROG = reactive organic gases
SCAQMD = Shasta County Air Quality Management District

The policy includes standard mitigation measures (SMM) and best available mitigation measures (BAMM). Briefly, the policy for applying SMMs and BAMMs is as follows:

- Apply SMM to all projects; this effort will help contribute to reducing cumulative effects.
- Apply SMM and appropriate BAMM when a project exceeds Level A thresholds.
- Apply SMM, BAMM, and special BAMM when a project exceeds Level B thresholds.
- If application of the above procedures will reduce project emissions below Level B thresholds, the project can proceed with an environmental determination of a mitigated negative declaration, assuming that other project impacts do not require more extensive environmental review.
- If project emissions cannot be reduced to below Level B thresholds, emission offsets will be required. If, after applying the emissions offsets, the project emissions still exceed the Level B threshold, an environmental impact report will be required before the project can be considered for action by the reviewing authority.

Thus, as recommended by SCAQMD, impacts of an alternative on air quality would be significant if either of the following would occur as a result of project implementation:

- Emissions of criteria air pollutants or precursors in Shasta County during construction or long-term operations would exceed the SCAQMD Level B thresholds of 137 pounds per day (lb/day) of ROG, NO_X, or PM_{10} and 500 lb/day of CO after the application of mitigation measures.

- Emissions of criteria air pollutants or precursors in Tehama County during construction or long-term operations would exceed 137 lb/day of ROG, NO_X, or PM_{10} after the application of mitigation measures.

SCAQMD has not adopted a numeric significance criterion for GHGs generated by nonindustrial projects. (However, two California air districts, the Bay Area Air Quality Management District and the South Coast Air Quality Management District, have adopted thresholds for GHG emissions generated by development projects.) No numeric thresholds adopted by any air district or by ARB would be applicable to the action alternatives. However, by adopting AB 32, the State has established GHG reduction targets. Further, the State has determined that GHG emissions, as they relate to global climate change, are a source of adverse environmental impacts in California and should be addressed under CEQA. AB 32 did not amend CEQA, although the legislation identifies the myriad environmental problems in California caused by global warming (Health and Safety Code, Section 38501(a)). SB 97, in contrast, did amend CEQA by requiring OPR to revise the State CEQA Guidelines to address the mitigation of GHG emissions or their consequences (California Public Resources Code, Sections 21083.05 and 21097).

Based on the size, scope, and purpose of this project, the following significance criteria will be used to determine the significance of GHG emissions from this project:

- Whether the project has the potential to conflict with or is consistent with the following plans to reduce or mitigate GHG emissions:

  – The six key elements of the *Climate Change Scoping Plan* (described previously)

  – ARB's 39 recommended actions in the *Climate Change Scoping Plan*

  – Regulations or requirements adopted to implement a statewide, regional, or local plan for the reduction or mitigation of GHG emissions

- Whether the project is part of a plan that includes overall reductions in GHG emissions

- Whether the relative amounts of GHG emissions over the life of the project are small in comparison to the amount of GHG emissions for major facilities that are required to report such emissions (25,000 MT CO_2e per year)

- Whether the project has the potential to contribute to a lower carbon future, through factors such as the following:

  – The design of the proposed project is inherently energy efficient

  – All applicable best management practices that would reduce GHG emissions are incorporated into the project design

  – The project implements or funds its fair share of a mitigation strategy designed to alleviate climate change

  – There are process improvements or efficiencies gained by implementing the project

5.3.3 Topics Eliminated from Further Consideration

No topics related to air quality and climate change that are included in the significance criteria listed above were eliminated from further consideration. All relevant topics are analyzed below.

5.3.4 Direct and Indirect Effects

No-Action Alternative

Shasta Lake and Vicinity and Upper Sacramento River (Shasta Dam to Red Bluff)

Impact AQ-1 (No-Action): Short-Term Emissions of Criteria Air Pollutants and Precursors at Shasta Lake and Vicinity During Project Construction No short-term, construction-related increases in emissions of criteria air pollutants or precursors at Shasta Lake or in the vicinity would result from implementation of the No-Action Alternative. No impact would occur.

Under the No-Action Alternative, no new facilities would be constructed at Shasta Lake or in the vicinity. No changes to Reclamation's existing facilities would occur that would directly or indirectly result in any increases in emissions of criteria air pollutants or precursors in this portion of the primary study area. Therefore, no impact would occur. Mitigation is not required for the No-Action Alternative.

Impact AQ-2 (No-Action): Long-Term Emissions of Criteria Air Pollutants and Precursors During Project Operation No long-term operational increases in emissions of criteria air pollutants or precursors in the primary study area would

result from implementation of the No-Action Alternative. However, PM_{10} emissions are expected to continue increasing through 2020 because of increased growth in the area. This impact would be less than significant.

Under the No-Action Alternative, no changes to Reclamation's existing operations in the primary study area would occur that would directly or indirectly result in any increases in emissions of criteria air pollutants or precursors in the primary study area. According to ARB, emission levels for ROG, NO_X, and CO are trending downward from 1990 to 2020 in the project area even with increased population growth (ARB 2009). More stringent mobile-source emission standards, cleaner burning fuels, and new rules have largely contributed to this decline. However, PM_{10} emissions are expected to continue increasing through 2020 because of increased growth in the area and associated emissions (e.g., from travel on paved and unpaved roads). Thus, such emissions will likely be worse in the future. Therefore, this impact would be less than significant. Mitigation is not required for the No-Action Alternative.

Impact AQ-3 (No-Action): Exposure of Sensitive Receptors to Substantial Pollutant Concentrations The No-Action Alternative would not change existing exposure of sensitive receptors to pollutants. No impact would occur.

Sensitive receptors in the primary study area are not currently exposed to substantial pollutant concentrations. There is no indication of circumstances under the No-Action Alternative that would change exposure levels. Therefore, no impact would occur. Mitigation is not required for the No-Action Alternative.

Impact AQ-4 (No-Action): Exposure of Sensitive Receptors to Odor Emissions The No-Action Alternative would not change existing exposure of sensitive receptors to odors. No impact would occur.

Sensitive receptors in the primary study area are not currently exposed to substantial concentrations of odors. There is no indication of circumstances under the No-Action Alternative that would change the exposure. Therefore, no impact would occur. Mitigation is not required for the No-Action Alternative.

Impact AQ-5 (No-Action): Short-Term Emissions of Criteria Air Pollutants and Precursors Below Shasta Dam During Project Construction No short-term, construction-related increases in emissions of criteria air pollutants or precursors below Shasta Dam would result from implementation of the No-Action Alternative. No impact would occur.

The Gravel Augmentation Program (proposed under CP4 and CP5, as described below) would not be implemented under the No-Action Alternative. No new facilities would be constructed below Shasta Dam. Furthermore, no changes to Reclamation's existing facilities or operations would occur that would directly or indirectly result in any increases in emissions of criteria air pollutants in this

portion of the primary study area. No impact would occur. Mitigation is not required for the No-Action Alternative.

Lower Sacramento River and Delta and CVP/SWP Service Areas No effects on climate and air quality are expected to occur in the lower Sacramento River and Delta and CVP/SWP service areas under the No-Action Alternative; therefore, potential effects in those geographic regions are not discussed further in this PDEIS.

Global Study Area

Impact AQ-6 (No-Action): Generation of Greenhouse Gases State goals to reduce project-related GHG emissions would not be implemented under this alternative; however, the No-Action Alternative would not obstruct or conflict with those goals. This impact would be less than significant.

Under the No-Action Alternative, no new facilities would be constructed. No changes to Reclamation's existing facilities or operations would occur that would directly or indirectly result in any increases or decreases in GHG emissions. Therefore, no efforts would be made to reduce existing GHG emissions in the project vicinity under this alternative. Although the State of California's goals to reduce GHG emissions would not be implemented, the No-Action Alternative would not obstruct or conflict with those goals. Therefore, this impact would be less than significant. Mitigation is not required for the No-Action Alternative.

CP1 – 6.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability

Shasta Lake and Vicinity

Impact AQ-1 (CP1): Short-Term Emissions of Criteria Air Pollutants and Precursors at Shasta Lake and Vicinity During Project Construction Project construction would result in short-term NO_X emissions that would exceed applicable SCAQMD thresholds, and could result in emissions that would exceed PM_{10} and ROG thresholds. This conclusion is based on calculations of estimated emissions for major elements of the project, and projection of additional emissions for other elements where calculation is not reasonable at the current level of project definition. Shasta County is a nonattainment area for the State ozone and PM_{10} standards. Thus, short-term emissions generated during construction could contribute substantially to an existing or projected air quality violation. This impact would be significant.

Construction emissions are described as "short-term" or temporary in duration because they would cease when the dam raise and associated construction projects are completed. The emissions of ozone precursors ROG and NO_X are associated primarily with gas and diesel engine equipment exhaust from off-road equipment and on-road vehicles. Off-road equipment anticipated in the project includes construction equipment such as bulldozers, cranes, welders, water trucks, loaders, and concrete batch plants. An additional off-road source

would be engine exhaust from helicopters used to airlift wood from clearing operations. On-road vehicles include trucks that would bring materials to the project site and haul excavated spoils and materials cleared from lands away from the project site. An additional on-road source would be the vehicles used by workers commuting to and from the project site. Engine equipment exhaust also emits CO, PM_{10}, and $PM_{2.5}$.

The primary sources of PM_{10} and $PM_{2.5}$ emissions are fugitive dust from site preparation, vehicle travel on unpaved and paved roads, and storage piles. Emissions vary as a function of such parameters as soil silt content, soil moisture, wind speed, acreage of disturbance area, and vehicle miles traveled by construction vehicles on- and off-site. Burning of cleared vegetation would be a substantial source of particulate emissions. PM_{10} and $PM_{2.5}$ would also be emitted during the materials handling processes associated with operation of a concrete batch plant.

Major construction elements under CP1 would be the dam raise of 6.5 feet and the clearing of land that would be inundated by the larger full pool. Land-clearing equipment used would be based on the terrain, and would range from full-size bulldozers to smaller backhoes and hand tools. In steep terrain helicopters would be used for material removal. In addition, wing dams and reservoir dikes would be constructed; railroad and roadway bridges would be replaced; roads, structures, and utilities would be relocated; and excavation and loading would occur at borrow areas to provide materials for dam construction.

To provide an initial, partial estimate of daily emission rates, it was assumed that the following construction activities would occur concurrently for a 3-year-long period:

- Dam raise, requiring two cranes, four off-road trucks, three dozers, two welders, two water trucks, and four other pieces of diesel engine equipment
- Trucking of materials to the dam site, with approximately 58 round trips per day of 20 miles per trip
- Clearing of acreage around the reservoir at a rate of 1.5 acres per day, using one tractor, two loader/backhoes, one water truck, and seasonal helicopters
- Trucking of materials cleared from the land, with approximately 23 round trips per day of 20 miles per trip

Emissions were calculated using the URBEMIS2007 model described above in Section 5.3.1, “Methods and Assumptions.” The results are shown in Table 5-4. (URBEMIS air quality modeling outputs for the comprehensive plans are presented in Attachment 1 to the *Air Quality and Climate Technical Report*.) As

seen in Table 5-4, NO_X emissions for the selected activities would exceed the Shasta County Level B threshold of 137 lb/day, which would result in a significant impact.

Particulate emissions from operation of a concrete batch plant are not included in the above calculations. Batch plants must obtain operating permits from Shasta County Air Pollution Control District. The granting of a permit would assure that the impact of PM_{10} and $PM_{2.5}$ emissions from batch plant sources would be less than significant.

Table 5-4 represents the initial partial emissions scenario. It is very likely that many other project-related activities using diesel-engine equipment would occur concurrently with the dam raise and the land clearing. It is also possible that the intensity of the dam raise and land clearing would be greater than assumed for the calculations. For example, the calculations for the dam raise assume an 8-hour work day; however, it is likely that some construction activities, such as mass concrete pours, would require 16- to 24-hour work days. With increases in concurrent activities and intensity of activity, it is anticipated that ROG and PM_{10} emissions would exceed the Level A significance threshold, and the potential exists for ROG and PM_{10} emissions to exceed the Level B thresholds of 137 lb/day.

Based on the data in Table 5-4 and the preceding discussion, short-term emissions generated during construction could contribute substantially to an existing or projected air quality violation. As a result, this impact would be significant.

The Shasta County standards require standard mitigation measures for all projects and additional mitigation measures when project emissions are anticipated to reach intermediate levels of 25 lb/day for ROG and NO_X, and 80 lb/day of PM_{10}. Mitigation for this impact that incorporates these mitigation measures is proposed in Section 5.3.5.

Table 5-4. Construction Emissions for Postulated Dam Raise and Land Clearing, 3-Year Construction Period – CP1[a]

Activity	Emissions—pounds per day				
	ROG	NO_X	CO	PM_{10}	$PM_{2.5}$
Dam Raise and Materials Trucking					
Off-road diesel	17	157	63	6	6
On-road diesel	2	37	12	2	1
Worker trips	<0.5	<0.5	5	<0.5	<0.5
Subtotal	20	194	81	8	7
Land Clearing and Spoils Trucking					
Fugitive dust	<0.5	<0.5	<0.5	30	6
Off-road diesel	3	18	9	1	1
On-road diesel	1	22	7	1	1
Worker trips	<0.5	<0.5	1	<0.5	<0.5
Subtotal	4	40	18	32	8
Total Dam Raise and Land Clearing (Year 1)[b]	**24**	**235**	**99**	**40**	**15**
Total Dam Raise and Land Clearing (Year 2)[b]	**22**	**219**	**92**	**39**	**15**
Total Dam Raise and Land Clearing (Year 3)[b]	**21**	**202**	**86**	**38**	**14**
SCAQMD Level A Significance Thresholds	**25**	**25**	**500**	**80**	**None**
SCAQMD Level B Significance Thresholds	**137**	**137**	**500**	**137**	**None**

Source: Data compiled by AECOM in 2011

Notes:
[a] Totals may not add due to rounding
[b] Years modeled were 2009, 2010, 2011.

Key:
CO = carbon monoxide
CP = Comprehensive Plan
NO_X = oxides of nitrogen
$PM_{2.5}$ = fine particulate matter
PM_{10} = respirable particulate matter
ROG = reactive organic gases
SCAQMD = Shasta County Air Quality Management District

Impact AQ-2 (CP1): Long-Term Emissions of Criteria Air Pollutants and Precursors During Project Operation Long-term project operation is not anticipated to result in ROG, NO_X, PM_{10}, or CO emissions that exceed applicable SCAMQD thresholds. Thus, long-term operational emissions would not be anticipated to violate an air quality standard or contribute substantially to an existing or projected air quality violation. This impact would be less than significant.

Long-term operational emissions would come from stationary, area, and mobile sources. Stationary sources could include emergency generators powered by

diesel engines or pumps, boilers, and major kitchen equipment. No new stationary sources of note are anticipated as part of the project. Replacement equipment that would emit pollutants is anticipated to be similar to equipment presently in operation.

Area sources include gas-fired building heating and hot water equipment, landscape maintenance equipment, and architectural coatings (paints, lacquers) used in maintenance. Area-source increases are anticipated to be negligible.

After completion of the dam raise, the principal sources of long-term emissions would be mobile sources; an increase in vehicle trips would result from increased recreational activity at Shasta Lake and the associated recreation areas. It is assumed that maintenance activity for the dam and recreation areas would not change markedly. No new stationary sources of emissions are anticipated as part of the project.

Enlarging Shasta Dam and including facilities to ensure that at least the existing recreation opportunities are maintained would affect recreation participation by increasing the reservoir's surface area throughout the year. Table 5-5 compares user days (visitor days) for each of the comprehensive plans to existing and future conditions. Studies are under way to identify increases in recreation facilities and recreation uses to be included in CP1. See the Economic Valuation Appendix for a full discussion of increases in user days.

Table 5-5. Average Annual Predicted Increase in User Days[a]

Item	CP1	CP2	CP3	CP4[b]	CP5
Increase in user days (thousands)	83	141	224	224	224

Source: Data compiled by EDAW (now AECOM) in 2008

Notes:
[a] All alternatives are to include features to, at minimum, maintain existing Shasta Lake recreation capacity.
[b] The extent of increased recreation due to added facilities is under development. Recreation use would surpass that for CP3 and CP5.

The increase in recreational opportunities and visitor days would generate vehicle trips for the travel of visitors to and from the Shasta Lake area. Increased vehicle emissions were calculated using the URBEMIS2007 model and the following assumptions:

- The average visitor stay is 2.5 days.
- The average number of visitors per vehicle is 2.5.
- The recreation season for most visitors is 180 days.
- The average one-way trip distance for visitors is 25 miles.
- The first year of operations is expected to be 2015 or later.

With these assumptions and the value of 83,000 increased visitor days from Table 5-5, there would be an increase of an average of 148 one-way trips per day under CP1. The results of the emissions calculations are shown in Table 5-6. Anticipated emissions would be less than the SCAQMD significance thresholds.

Table 5-6. Operations Emissions for Shasta Dam Raise, 2015 – CP1

Activity	Emissions—pounds per day				
	ROG	NO_X	CO	PM_{10}	$PM_{2.5}$
Vehicle trips for increase in recreational visitors	2	4	35	6	1
SCAQMD Level A Significance Thresholds	**25**	**25**	**500**	**80**	**None**
SCAQMD Level B Significance Thresholds	**137**	**137**	**500**	**137**	**None**

Source: Data compiled by EDAW (now AECOM) in 2008

Note: Totals may not add due to rounding.

Key:
CO = carbon monoxide
CP = Comprehensive Plan
NO_X = oxides of nitrogen
$PM_{2.5}$ = fine particulate matter
PM_{10} = respirable particulate matter
ROG = reactive organic gases
SCAQMD = Shasta County Air Quality Management District

Based on the above analysis, operation under CP1 would not result in ROG, NO_X, PM_{10}, or CO emissions that exceed applicable SCAQMD Level A thresholds. Consequently, long-term emissions during project operation under CP1 would not be anticipated to violate an air quality standard or contribute substantially to an existing or projected air quality violation. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact AQ-3 (CP1): Exposure of Sensitive Receptors to Substantial Pollutant Concentrations Neither short-term construction nor long-term operational sources would expose sensitive receptors to substantial concentrations of CO, PM_{10}, $PM_{2.5}$, or TACs. This impact would be less than significant.

Pollutants of concern for exposure of sensitive receptors include CO, PM_{10} and $PM_{2.5}$, and TACs. Local exposure of CO may occur near severe congestion on major roadways. The project is not anticipated to generate areas of severe roadway congestion, nor would the project locate receptors near major roadways; no local CO impact would occur.

Sensitive receptors could be exposed to substantial amounts of PM_{10} and $PM_{2.5}$ if receptors were located near large areas of grading or earthmoving and dust generation was not controlled. Similarly, substantial exposure to particulates and other smoke-borne pollutants could result if receptors were near areas

where cleared brush would be burned. There are no sensitive receptors near the dam raise areas; however, there may be sensitive receptors near the some of the lands that would be cleared before inundation by the expanded reservoir. Dust control measures would be required for all land clearing activities; these measures would prevent most PM_{10} and $PM_{2.5}$ from reaching sensitive receptors. Similarly, smoke control measures would be required by SCAQMD Rule 2:7. The impact of exposure of sensitive receptors to PM_{10} and $PM_{2.5}$ would be less than significant.

The principal TAC of concern for project construction is diesel PM. Diesel PM would be generated in the exhaust of diesel engine construction equipment. The largest concentration of diesel engines would be located at the dam raise site. There are no sensitive receptors within one-half mile of the dam site, and sensitive receptors would not be exposed to diesel PM from that source. Diesel equipment would be used for land clearing operations, and there may be sensitive receptors near the land clearing. The dose to which receptors are exposed is the primary factor used to determine health risk (i.e., potential exposure to TAC emission levels that exceed applicable standards). Dose is a function of the concentration of a substance or substances in the environment and the duration of exposure to the substance. Dose is positively correlated with time, meaning that a longer exposure period would result in a higher exposure level for the maximally exposed individual. Thus, the risks estimated for a maximally exposed individual are higher if a fixed exposure occurs over a longer period of time. According to the Office of Environmental Health Hazard Assessment, health risk assessments, which determine the exposure of sensitive receptors to TAC emissions, should be based on a 70-year exposure period; however, such assessments should be limited to the period/duration of activities associated with the project. Thus, because the use of off-road construction equipment would be limited to a few days near any sensitive receptor, short-term construction activities would not result in exposure of sensitive receptors to substantial TAC emissions.

Project implementation is not expected to result in the operation of any new significant sources of TAC emissions after construction is complete. Thus, short-term construction and long-term operational sources would not expose sensitive receptors to substantial TAC concentrations. As a result, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact AQ-4 (CP1): Exposure of Sensitive Receptors to Odor Emissions
Short-term construction and long-term operational sources would not expose sensitive receptors to substantial odor emissions. This impact would be less than significant.

The occurrence and severity of odor impacts depend on numerous factors: the nature, frequency, and intensity of the source; wind speed and direction; and the presence of sensitive receptors. Although offensive odors rarely cause any

physical harm, they still can be very unpleasant, leading to considerable distress and often generating citizen complaints to local governments and regulatory agencies.

Diesel exhaust has some odor, but it dissipates rapidly from the source with an increase in distance. There are no sensitive receptors immediately adjacent to the project site and people would not be exposed to substantial odors in that area. At other work sites, construction equipment use would be intermittent and temporary, resulting in an odor impact that would be less than significant.

Project implementation would not develop any major sources of odor. The project does not include one of the common types of facilities that are known to produce odors such as a landfill or a coffee roaster. Thus, short-term construction and long-term operational sources would not expose sensitive receptors to substantial odor emissions. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Upper Sacramento River (Shasta Dam to Red Bluff)
Impact AQ-5 (CP1): Short-Term Emissions of Criteria Air Pollutants and Precursors Below Shasta Dam During Project Construction The Gravel Augmentation Program and habitat restoration at Reading Island proposed under CP4 and CP5 would not be implemented under CP1. No other project construction or long-term operation activities that would affect emissions of criteria air pollutants and precursors are planned in the Shasta Dam–to–Red Bluff area under CP1. Therefore, no impact would occur.

The Gravel Augmentation Program and habitat restoration at Reading Island (proposed under CP4 and CP5, as described below) would not be implemented under CP1. No new facilities would be constructed below Shasta Dam under this alternative, and no changes in Reclamation's existing facilities or operations would occur that would directly or indirectly result in any increases in criteria air pollutant emissions in this portion of the primary study area. No impact would occur. Mitigation for this impact is not needed, and thus not proposed.

Lower Sacramento River and Delta and CVP/SWP Service Areas No effects on climate and air quality are expected to occur in the lower Sacramento River and Delta and CVP/SWP service areas under CP1; therefore, potential effects in those geographic regions are not discussed further in this PDEIS.

Global Study Area
Impact AQ-6 (CP1): Generation of Greenhouse Gases Project construction activities would result in emission of a less than significant quantity of GHGs. Project operation would result in beneficial effects on GHG emissions because generation of electricity at Shasta Dam would increase. This impact would be less than significant.

There are no established quantitative criteria under CEQA for determining a significant impact related to GHG emissions. The criteria suggested by various agencies principally address long-term emissions, and not the relatively short-term emissions of construction activities. One of the more commonly suggested mass emissions thresholds is 25,000 MT CO_2e per year. This value has been selected because it is the threshold established for mandatory emissions reporting for most sources in California under AB 32.

For an initial estimate of construction-phase GHG emissions, the URBEMIS model was used with the same assumptions that were used to estimate criteria pollutant emissions, as described above for Shasta Lake and vicinity (see Impact AQ-1 (CP1)). URBEMIS calculations found that the dam raise and land clearing activities would generate 2,283–3,938 tons per year of CO_2 for the 3 years of construction, which is equal to 2,071–3,572 MT. URBEMIS does not calculate emissions of GHGs other than CO_2; for emissions that are generated primarily by construction equipment, the CO_2e value would be 3–5 percent greater than the CO_2 value. As described above, there could be considerably more construction activity and more intense activity than assumed for the calculations. Further, the calculations are limited to CO_2 produced by construction equipment and on-road vehicles, and do not include CO_2 emissions attributed to processes such as making concrete or welding. Therefore, it is not unreasonable to assume that construction activities could emit GHGs on the order of 10,000 MT CO_2e per year.

GHG emissions of sequestered carbon in removed vegetation were calculated at 4,034 MT CO_2e per year for CP1. This calculation assumes that all vegetation removal, overstory removal, and relocation acreages (473 acres total) would be covered in 70-year-old stands of forest vegetation (Ponderosa pine, Douglas-fir, montane hardwood-conifer, and montane hardwood forest) and that all above-ground vegetation would be disposed of in a manner that releases the sequestered carbon into the atmosphere. All 473 acres would not be covered with 70-year forest as used in the model (ages would vary) or release all carbon to the atmosphere. Also, most utilities would be relocated in roadways, but separate relocation (and additional disturbance) was assumed in the estimated relocation acreages. This approach was applied to ensure that underestimating would not occur.

With implementation of CP1, increased activity by recreational visitors to the Shasta Lake area would result in additional vehicle trips and estimated CO_2 emissions of 3,435 lb/day, as calculated with URBEMIS. The calculations assumed 180 days of visitor activity; the annual emissions would be 309 tons per year of CO_2. Vehicles emit other GHGs in addition to CO_2; the annual GHG emissions are estimated at 324 tons (approximately 294 MT) CO_2e.

Increasing the size of Shasta Dam and Shasta Lake would result in the ability to increase hydropower generation at Shasta generating facilities. Generation of electricity by hydropower reduces the need for fossil-fuel generation of

electricity and the GHG emissions that would occur with that generation. Raising Shasta Dam by 6.5 feet and implementing the operational strategy for CP1 would result in a net increase in power generation of 17 gigawatt-hours (GWh) per year (Table 5-7). This net generation estimate accounts for the energy required for pumping the increased water supplies. Fossil-fuel generation of 17 GWh of energy would produce an estimated 15,100 MT of CO_2, also shown in Table 5-7. Therefore, the increased generation of electricity at Shasta Dam would reduce the need to build facilities for fossil-fueled generation of 17 GWh per year in the global study area.

Table 5-7. Average Annual Hydropower Generation Benefits

Item	CP1	CP2	CP3	CP4	CP5
Net increased generation (GWh/year)	17	42	54	94	54
CO_2 displaced (1,000 metric tons)	15.1	37.5	48.2	83.4	48.2

Source: Data compiled by EDAW (now AECOM) in 2008

Key:
CO_2 = carbon dioxide
CP = Comprehensive Plan
GWh/year = gigawatt-hours per year

The results of the above analysis show that CP1 would result in short-term emissions of GHG for the years of construction, followed by long-term benefits of GHG reduction through generation of electricity at Shasta Dam. The magnitude of the GHG "savings" for each year of operation, approximately 15,000 MT, would be greater than the potential annual construction emissions, which may be on the order of 14,034 MT (10,000 from exhaust emission, 4,034 from loss of carbon sequestered in vegetation). Further, construction emissions of 14,034 MT CO_2e per year would be less than the suggested significance threshold of 25,000 MT.

The GHG emissions from construction activities would be temporary in duration and mitigated to the extent feasible; therefore, such emissions would not conflict with State or regional planning efforts or emit GHG in excess of mandatory reporting standards. GHG emissions from long-term operations would likely have a net benefit as a result of increased hydroelectric generation and would thus also not conflict with planning efforts or mandatory reporting thresholds. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

In addition to the effects described above, the loss of vegetation presently in the area that would be inundated would likely result in a loss of CO_2 absorption by that vegetation, as well as increased emissions of decomposing material present in the lake as a result of increases volume. There may be some offset to this effect with increased surface area of Shasta Lake for absorption. These effects are speculative and infeasible to quantify at this time.

CP2 – 12.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability

Shasta Lake and Vicinity

Impact AQ-1 (CP2): Short-Term Emissions of Criteria Air Pollutants and Precursors at Shasta Lake and Vicinity During Project Construction Project construction would result in short-term NO_X emissions that would exceed applicable SCAMQD thresholds, and could result in emissions that would exceed PM_{10} or ROG thresholds. This conclusion is based on calculations of estimated emissions for major elements of the project, and projection of additional emissions for other elements where calculation is not reasonable at the current level of project definition. Shasta County is a nonattainment area for the State ozone and PM_{10} standards. Thus, short-term emissions generated during construction could contribute substantially to an existing or projected air quality violation. This impact would be significant.

This impact would be similar to Impact AQ-1 (CP1). CP2 would include a dam raise of 12.5 feet and land clearing of an area likely to be greater than for CP1. These are larger values than for CP1, but the construction period would be longer and not substantially more intense. The SCAQMD thresholds are based on maximum daily emissions, and the maximum daily activity is not anticipated to be extraordinarily greater with CP2 than with CP1. For the same reasons as described for CP1, this impact would be significant. Mitigation for this impact is proposed in Section 5.3.5.

Impact AQ-2 (CP2): Long-Term Emissions of Criteria Air Pollutants and Precursors During Project Operation Long-term project operation is not anticipated to result in ROG, NO_X, PM_{10}, or CO emissions that exceed applicable SCAQMD thresholds. Thus, long-term operational emissions would not be anticipated to violate an air quality standard or contribute substantially to an existing or projected air quality violation. This impact would be less than significant.

Long-term operational emissions would come from stationary, area, and mobile sources. This impact would be the same as Impact AQ-2 (CP1) for stationary and area sources and similar to Impact AQ-2 (CP1) for mobile sources. With CP2, there would be an annual increase of 141,000 visitor days, as was shown in Table 5-5, resulting in 251 average daily trips. The associated daily emissions are shown in Table 5-8.

Based on the above analysis, operation under CP2 would not result in ROG, NO_X, PM_{10}, or CO emissions that exceed applicable SCAQMD Level A thresholds. Consequently, long-term emissions during project operation under CP2 would not violate an air quality standard or contribute substantially to an existing or projected air quality violation. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 5-8. Operations Emissions for Shasta Dam Raise, 2015 – CP2

Activity	Emissions—pounds per day				
	ROG	NO_X	CO	PM_{10}	$PM_{2.5}$
Vehicle trips for increase in recreational visitors	4	7	59	11	2
SCAQMD Level A significance thresholds	25	25	500	80	None
SCAQMD Level B significance thresholds	137	137	500	137	None

Source: Data compiled by EDAW (now AECOM) in 2008

Key:
CO = carbon monoxide
CP = Comprehensive Plan
NO_X = oxides of nitrogen
$PM_{2.5}$ = fine particulate matter
PM_{10} = respirable particulate matter
ROG = reactive organic gases
SCAQMD = Shasta County Air Quality Management District

Impact AQ-3 (CP2): Exposure of Sensitive Receptors to Substantial Pollutant Concentrations Neither short-term construction nor long-term operational sources would expose sensitive receptors to substantial concentrations of CO, PM_{10}, $PM_{2.5}$, or TACs. This impact would be less than significant.

This impact would be the same as Impact AQ-3 (CP1) and would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact AQ-4 (CP2): Exposure of Sensitive Receptors to Odor Emissions Short-term construction and long-term operational sources would not expose sensitive receptors to substantial odor emissions. This impact would be less than significant.

This impact would be the same as Impact AQ-4 (CP1) and would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Upper Sacramento River (Shasta Dam to Red Bluff)
Impact AQ-5 (CP2): Short-Term Emissions of Criteria Air Pollutants and Precursors Below Shasta Dam During Project Construction The Gravel Augmentation Program and habitat restoration at Reading Island proposed under CP4 and CP5 would not be implemented under CP2. No other project construction or long-term operation activities that would affect emissions of criteria air pollutants and precursors are planned in the Shasta Dam–to–Red Bluff area under CP2. Therefore, no impact would occur.

This impact would be the same as Impact AQ-5 (CP1). No impact would occur. Mitigation for this impact is not needed, and thus not proposed.

Lower Sacramento River and Delta and CVP/SWP Service Areas No effects on climate and air quality are expected to occur in the lower Sacramento

River and Delta and CVP/SWP service areas under CP2; therefore, potential effects in those geographic regions are not discussed further in this PDEIS.

Global Study Area

Impact AQ-6 (CP2): Generation of Greenhouse Gases Project construction activities would result in a less than significant quantity of emission of GHG. Project operations would result in beneficial effects on GHG emissions because generation of electricity at Shasta Dam would increase. This impact would be less than significant.

This impact would be similar to Impact AQ-6 (CP1) for construction and operations. With implementation of CP2, increased activity by recreational visitors to the Shasta Lake area would result in additional vehicle trips and estimated CO_2 emissions of 5,825 lb/day, as calculated with URBEMIS. The annual GHG emissions are estimated at 550 tons (approximately 500 MT) CO_2e. This amount would be approximately 225 MT greater than CP1.

Raising Shasta Dam by 12.5 feet and implementing the operational strategy for CP2 would result in a net increase in power generation of 42 GWh per year (Table 5-7). Fossil-fuel generation of 42 GWh of energy would produce an estimated 37,500 MT CO_2, also shown in Table 5-7. Thus, CP2 would reduce the need to build facilities for fossil-fueled generation of 17 GWh per year in the global study area.

CP2 would result in short-term emissions of GHG for the years of construction, followed by long-term benefits of GHG reduction through generation of electricity at Shasta Dam. The magnitude of the GHG "savings" for each year of operation, approximately 37,000 MT, would be greater than the potential annual construction emissions, which may be on the order of 10,000 MT from exhaust emissions and 5,910 MT from loss of carbon sequestered in existing vegetation. Further, construction emissions of 15,910 MT CO_2e per year would be less than the suggested significance threshold of 25,000 MT. It is concluded that the short-term impact would be less than significant, and that the overall net impact would be beneficial. Mitigation for this impact is not needed, and thus not proposed.

CP3 – 18.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply

Shasta Lake and Vicinity

Impact AQ-1 (CP3): Short-Term Emissions of Criteria Air Pollutants and Precursors at Shasta Lake and Vicinity During Project Construction Project construction would result in short-term NO_X emissions that would exceed applicable SCAQMD thresholds, and could result in emissions that would exceed PM_{10} or ROG thresholds. This conclusion is based on calculations of estimated emissions for major elements of the project, and projection of additional emissions for other elements where calculation is not reasonable at the current level of project definition. Shasta County is a nonattainment area for the State ozone and PM_{10} standards. Thus, short-term emissions generated

during construction could contribute substantially to an existing or projected air quality violation. This impact would be significant.

This impact would be similar to Impact AQ-1 (CP1). CP3 would include a dam raise of 18.5 feet and land clearing of approximately 1,000 acres. These are larger values than for CP1, but the construction period would be longer and not substantially more intense, considering the margins for increase discussed in Impact AQ-1 (CP1). The SCAQMD thresholds are based on maximum daily emissions, and the maximum daily activity is not anticipated to be substantially greater with CP3 than with CP1. For the same reasons as described for CP1, this impact would be significant. Mitigation for this impact is proposed in Section 5.3.5.

Impact AQ-2 (CP3): Long-Term Emissions of Criteria Air Pollutants and Precursors During Project Operation Long-term project operation is not anticipated to result in ROG, NO_X, PM_{10}, or CO emissions that exceed applicable SCAQMD thresholds. Thus, long-term operational emissions would not be anticipated to violate an air quality standard or contribute substantially to an existing or projected air quality violation. This impact would be less than significant.

Long-term operational emissions would come from stationary, area, and mobile sources. This impact would be the same as Impact AQ-2 (CP1) for stationary and area sources and similar to Impact AQ-2 (CP1 and CP2) for mobile sources. With CP3, there would be an annual increase of 224,000 visitor days, as was shown in Table 5-5, resulting in 398 average daily trips. The associated daily emissions are shown in Table 5-9. Overall trip levels would be greater than under CP1 and CP2, but emissions would remain below significance thresholds.

Table 5-9. Operations Emissions for Shasta Dam Raise, 2015—CP3

Activity	Emissions—pounds per day				
	ROG	NO_X	CO	PM_{10}	$PM_{2.5}$
Vehicle trips for increase in recreational visitors	6	11	94	17	3
SCAQMD Level A significance thresholds	25	25	500	80	None
SCAQMD Level B significance thresholds	137	137	500	137	None

Source: Data compiled by EDAW (now AECOM) in 2008

Key:
CO = carbon monoxide
CP = Comprehensive Plan
NO_X = oxides of nitrogen
$PM_{2.5}$ = fine particulate matter
PM_{10} = respirable particulate matter
ROG = reactive organic gases
SCAQMD = Shasta County Air Quality Management District

Based on the above analysis, operation under CP3 would not result in ROG, NO_X, PM_{10}, or CO emissions that exceed SCAQMD Level A thresholds.

Consequently, long-term emissions during operation under CP3 would not violate an air quality standard or contribute substantially to an existing or projected air quality violation. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact AQ-3 (CP3): Exposure of Sensitive Receptors to Substantial Pollutant Concentrations Neither short-term construction nor long-term operational sources would expose sensitive receptors to substantial concentrations of CO, PM_{10}, $PM_{2.5}$, or TACs. This impact would be less than significant.

This impact would be the same as Impact AQ-3 (CP1) and would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact AQ-4 (CP3): Exposure of Sensitive Receptors to Odor Emissions Short-term construction and long-term operational sources would not expose sensitive receptors to substantial odor emissions. This impact would be less than significant.

This impact would be the same as Impact AQ-4 (CP1) and would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Upper Sacramento River (Shasta Dam to Red Bluff)
Impact AQ-5 (CP3): Short-Term Emissions of Criteria Air Pollutants and Precursors Below Shasta Dam During Project Construction The Gravel Augmentation Program and habitat restoration at Reading Island proposed under CP4 and CP5 would not be implemented under CP3. No other project construction or long-term operation activities that would affect emissions of criteria air pollutants and precursors are planned in the Shasta Dam–to–Red Bluff area under CP3. Therefore, no impact would occur.

This impact would be the same as Impact AQ-5 (CP1). No impact would occur. Mitigation for this impact is not needed, and thus not proposed.

Lower Sacramento River and Delta and CVP/SWP Service Areas No effects on climate and air quality are expected to occur in the lower Sacramento River and Delta and CVP/SWP service areas under CP3; therefore, potential effects in those geographic regions are not discussed further in this PDEIS.

Global Study Area
Impact AQ-6 (CP3): Generation of Greenhouse Gases Project construction activities would result in a less than significant quantity of emission of GHGs. Project operations would result in beneficial effects on GHG emissions because generation of electricity at Shasta Dam would increase. This impact would be less than significant.

This impact would be similar to Impact AQ-6 (CP1) for construction and operations. With implementation of CP3, increased activity by recreational visitors to the Shasta Lake area would result in additional vehicle trips and

estimated CO_2 emissions of 9,238 lb/day, as calculated with URBEMIS. The annual GHG emissions are estimated at 873 tons (approximately 792 MT) CO_2e.

Raising Shasta Dam by 18.5 feet and implementing the operational strategy for CP3 would result in a net increase in power generation of 54 GWh per year, as was shown in Table 5-7. Fossil-fuel generation of 54 GWh of energy would produce an estimated 48,500 MT of CO_2, also shown in Table 5-7. Thus, CP3 would reduce the need to build facilities for fossil-fueled generation of 17 GWh per year in the global study area.

CP3 would result in relatively small short-term emissions of GHGs for the years of construction, followed by long-term benefits of GHG reduction through generation of electricity at Shasta Dam. The magnitude of the GHG "savings" for each year of operation, approximately 48,500 MT, would be greater than the potential annual construction emissions, which may be on the order of 10,000 MT from exhaust emissions and 8,163 MT from loss of carbon sequestered in existing vegetation. Further, construction emissions of 18,163 MT CO_2e per year would be less than the suggested significance threshold of 25,000 MT. It is concluded that the short-term impact would be less than significant, and that the overall net impact would be beneficial. Mitigation for this impact is not needed, and thus not proposed.

CP4 – 18.5-Foot Dam Raise, Anadromous Fish Focus with Water Supply Reliability

Shasta Lake and Vicinity

Impact AQ-1 (CP4): Short-Term Emissions of Criteria Air Pollutants and Precursors at Shasta Lake and Vicinity During Project Construction Project construction would result in short-term NO_X emissions that would exceed applicable SCAQMD thresholds, and could result in emissions that would exceed PM_{10} or ROG thresholds. This conclusion is based on calculations of estimated emissions for major elements of the project, and projection of additional emissions for other elements where calculation is not reasonable at the current level of project definition. Shasta County is a nonattainment area for the State ozone and PM_{10} standards. Thus, short-term emissions generated during construction could contribute substantially to an existing or projected air quality violation. This impact would be significant.

This impact would be similar to Impact AQ-1 (CP3) and would be significant. Mitigation for this impact is proposed in Section 5.3.5.

Impact AQ-2 (CP4): Long-Term Emissions of Criteria Air Pollutants and Precursors During Project Operation Long-term project operation is not anticipated to result in ROG, NO_X, PM_{10}, or CO emissions that exceed applicable SCAQMD thresholds. Thus, long-term operational emissions would not be anticipated to violate an air quality standard or contribute substantially to

an existing or projected air quality violation. This impact would be less than significant.

Long-term operational emissions would come from stationary, area, and mobile sources. This impact would be the same as Impact AQ-2 (CP1) for stationary and area sources and the same as Impact AQ-2 (CP3) for mobile sources. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact AQ-3 (CP4): Exposure of Sensitive Receptors to Substantial Pollutant Concentrations Neither short-term construction nor long-term operational sources would expose sensitive receptors to substantial concentrations of CO, PM_{10}, $PM_{2.5}$, or TACs. This impact would be less than significant.

This impact would be the same as Impact AQ-3 (CP1) and would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact AQ-4 (CP4): Exposure of Sensitive Receptors to Odor Emissions Short-term construction and long-term operational sources would not expose sensitive receptors to substantial odor emissions. This impact would be less than significant.

This impact would be the same as Impact AQ-4 (CP1) and would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Upper Sacramento River (Shasta Dam to Red Bluff)

Impact AQ-5 (CP4): Short-Term Emissions of Criteria Air Pollutants and Precursors Below Shasta Dam During Project Construction The Gravel Augmentation Program proposed for areas along the upper Sacramento River would add to emissions of ROG, NO_X, and PM_{10} from project construction. Habitat restoration activities at Reading Island would also add ROG, NO_X, and PM_{10} emissions. However, these emissions separately and combined would add negligible amounts to annual emission levels. This impact would be less than significant.

The Gravel Augmentation Program proposed under CP4 would add an additional 1 lb/day of ROG, 16 lb/day of NO_X, and 1 lb/day of PM_{10} to project construction emission levels. Emissions from gravel augmentation would be from gravel material hauling consisting of approximately 18 trips per day, 40 miles round trip to sites identified to the south along the Sacramento River. Gravel augmentation would only occur for 2 months out of the year; therefore, these emissions would add negligible amounts to annual emission levels.

Habitat restoration at Reading Island proposed under CP4 would add an additional 6.7 lb/day of ROG, 50.1 lb/day of NO_X, and 12.4 lb/day of PM_{10} to project construction emission levels. During habitat restoration, emissions would be generated from removing vegetation from the Sacramento River's side channel, removing noxious invasive plant species from the island, minor

grading, and hauling away waste materials (approximately 25 trips per day). Restoration activities would occur for only 2 months for a total of 44 8-hour work days; therefore, these emissions would add negligible amounts to annual emission levels.

The combined emissions from the Gravel Augmentation Program and habitat restoration at Reading Island would be 7.7 lb/day of ROG, 76 lb/day of NO_X, and 13.4 lb/day of PM_{10}. These emissions are below SCAQMD's Level A thresholds of 25 lb/day of ROG, 25 lb/day of NO_X, and 80 lb/day of PM_{10}. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Lower Sacramento River and Delta and CVP/SWP Service Areas No effects on climate and air quality are expected to occur in the lower Sacramento River and Delta and CVP/SWP service areas under CP4; therefore, potential effects in those geographic regions are not discussed further in this PDEIS.

Global Study Area

Impact AQ-6 (CP4): Generation of Greenhouse Gases Project construction activities would result in a less than significant quantity of emission of GHGs. Project operation would result in beneficial effects on GHG emissions because generation of electricity at Shasta Dam would increase. This impact would be less than significant.

This impact would be similar to Impact AQ-6 (CP1) for construction and operations. With implementation of CP4, increased activity by recreational visitors to the Shasta Lake area would result in additional vehicle trips and estimated CO_2 emissions of 9,238 lb/day, as calculated with URBEMIS. The annual GHG emissions are estimated at 872 tons (approximately 792 MT) CO_2e.

Raising Shasta Dam by 18.5 feet and implementing the operational strategy for CP4 would result in a net increase in power generation of 94 GWh per year (Table 5-7). Fossil-fuel generation of 94 GWh of energy would produce an estimated 83,400 MT CO_2 (Table 5-7). Thus, CP4 would reduce the need to build facilities for fossil-fueled generation of 17 GWh per year in the global study area.

CP4 would result in short-term emissions of GHGs for the years of construction, followed by long-term benefits of GHG reduction through generation of electricity at Shasta Dam. The magnitude of the GHG "savings" for each year of operation, approximately 83,400 MT, would be greater than the potential annual construction emissions, which may be on the order of 10,000 MT from exhaust emissions and 8,163 MT from loss of carbon sequestered in existing vegetation. Further, construction emissions of 18,163 MT CO_2e per year would be less than the suggested significance threshold of 25,000 MT. It is concluded that the short-term impact would be less than significant, and that the

overall net impact would be beneficial. Mitigation for this impact is not needed, and thus not proposed.

CP5 – 18.5-Foot Dam Raise, Combination Plan

Shasta Lake and Vicinity

Impact AQ-1 (CP5): Short-Term Emissions of Criteria Air Pollutants and Precursors at Shasta Lake and Vicinity During Project Construction Project construction would result in short-term NO_X emissions that would exceed applicable SCAQMD thresholds, and could result in emissions that would exceed PM_{10} or ROG thresholds. This conclusion is based on calculations of estimated emissions for major elements of the project, and projection of additional emissions for other elements where calculation is not reasonable at the current level of project definition. Shasta County is a nonattainment area for the State ozone and PM_{10} standards. Thus, short-term emissions generated during construction could contribute substantially to an existing or projected air quality violation. This impact would be significant.

This impact would be similar to Impact AQ-1 (CP3) and would be significant. Mitigation for this impact is proposed in Section 5.3.5.

Impact AQ-2 (CP5): Long-Term Emissions of Criteria Air Pollutants and Precursors During Project Operation Long-term project operation is not anticipated to result in ROG, NO_X, PM_{10}, or CO emissions that exceed applicable SCAQMD thresholds. Thus, long-term operational emissions would not be anticipated to violate an air quality standard or contribute substantially to an existing or projected air quality violation. This impact would be less than significant.

Long-term operational emissions would come from stationary, area, and mobile sources. This impact would be the same as Impact AQ-2 (CP1) for stationary and area sources and similar to Impact AQ-2 (CP3) for mobile sources. With CP5, the annual increase in visitor days has not been estimated, as was shown in Table 5-5; however, visitor days are expected to surpass the 224,000 forecast for CP3 and CP4. For purposes of impact assessment, it was assumed that there would be an annual increase of 400,000 visitor days with CP5, resulting in 711 average daily trips. The associated daily emissions are shown in Table 5-10.

Based on the above analysis, operation of CP5 would not result in ROG, NO_X, PM_{10}, or CO emissions that exceed applicable SCAQMD Level A thresholds. Consequently, long-term operational emissions would not violate an air quality standard or contribute substantially to an existing or projected air quality violation. As a result, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 5-10. Operations Emissions for Shasta Dam Raise, 2015 – CP5

Activity	Emissions—pounds per day				
	ROG	NO_X	CO	PM_{10}	$PM_{2.5}$
Vehicle trips for increase in recreational visitors	11	20	168	31	6
SCAQMD Level A significance thresholds	25	25	500	80	None
SCAQMD Level B significance thresholds	137	137	500	137	None

Source: Data compiled by EDAW (now AECOM) in 2008

Key:
CO = carbon monoxide
CP = Comprehensive Plan
NO_X = oxides of nitrogen
$PM_{2.5}$ = fine particulate matter
PM_{10} = respirable particulate matter
ROG = reactive organic gases
SCAQMD = Shasta County Air Quality Management District

Impact AQ-3 (CP5): Exposure of Sensitive Receptors to Substantial Pollutant Concentrations Neither short-term construction nor long-term operational sources would expose sensitive receptors to substantial concentrations of CO, PM_{10}, $PM_{2.5}$, or TACs. This impact would be less than significant.

This impact would be the same as Impact AQ-3 (CP1) and would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact AQ-4 (CP5): Exposure of Sensitive Receptors to Odor Emissions Short-term construction and long-term operational sources would not expose sensitive receptors to substantial odor emissions. This impact would be less than significant.

This impact would be the same as Impact AQ-4 (CP1) and would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Upper Sacramento River (Shasta Dam to Red Bluff)
Impact AQ-5 (CP5): Short-Term Emissions of Criteria Air Pollutants and Precursors Below Shasta Dam During Project Construction The Gravel Augmentation Program proposed for areas along the upper Sacramento River would add to emissions of ROG, NO_X, and PM_{10} from project construction. However, these emissions would add negligible amounts to annual emission levels. This impact would be less than significant.

This impact would be the same as Impact AQ-5 (CP4) and would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Lower Sacramento River and Delta and CVP/SWP Service Areas No effects on climate and air quality are expected to occur in the lower Sacramento

River and Delta and CVP/SWP service areas under CP5; therefore, potential effects in those geographic regions are not discussed further in this PDEIS.

Global Study Area

Impact AQ-6 (CP5): Generation of Greenhouse Gases Project construction activities would result in a less than significant quantity of emission of GHG. Project operation would result in beneficial effects on GHG emissions because generation of electricity at Shasta Dam would increase. This impact would be less than significant.

This impact would be similar to Impact AQ-5 (CP1) for construction and for operations. With implementation of CP5, increased activity by recreational visitors to the Shasta Lake area would result in additional vehicle trips and estimated CO_2 emissions of 16,503 lb/day, as calculated with URBEMIS. The annual GHG emissions are estimated at 1,560 tons (approximately 1,415 MT) CO_2e.

Raising Shasta Dam by 18.5 feet and implementing the operational strategy for CP5 would result in a net increase in power generation of 54 GWh per year, as was shown in Table 5-7. Fossil fuel generation of 54 GWh of energy would produce an estimated 48,500 MT CO_2, also shown in Table 5-7. Thus, CP5 would reduce the need to build facilities for fossil-fueled generation of 17 GWh per year in the global study area.

CP5 would result in short-term emissions of GHGs for the years of construction, followed by long-term benefits of GHG reduction through generation of electricity at Shasta Dam. The magnitude of the GHG "savings" for each year of operation, approximately 48,500 MT, would be greater than the potential annual construction emissions, which may be on the order of 10,000 MT from exhaust emissions and 8,311 MT from loss of carbon sequestered in existing vegetation. Further, construction emissions of 18,311 MT CO_2e per year would be less than the suggested significance threshold of 25,000 MT. It is concluded that the short-term impact would be less than significant, and that the overall net impact would be beneficial. Mitigation for this impact is not needed, and thus not proposed.

5.3.5 Mitigation Measures

Table 5-11 presents a summary of mitigation measures for air quality and climate.

Table 5-11. Summary of Mitigation Measures for Air Quality and Climate Change

		No-Action Alternative	CP1	CP2	CP3	CP4	CP5
Impact AQ-1: Short-Term Emissions of Criteria Air Pollutants and Precursors at Shasta Lake and Vicinity During Project Construction	LOS before Mitigation	NI	S	S	S	S	S
	Mitigation Measure	None required.	Mitigation Measure AQ-1: Implement Standard Measures and Best Available Mitigation Measures to Reduce Emissions Levels.				
	LOS after Mitigation	NI	SU	SU	SU	SU	SU
Impact AQ-2: Long-Term Emissions of Criteria Air Pollutants and Precursors During Project Operation	LOS before Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required.	None needed; thus, none proposed.				
	LOS after Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
Impact AQ-3: Exposure of Sensitive Receptors to Substantial Pollutant Concentrations	LOS before Mitigation	NI	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required.	None needed; thus, none proposed.				
	LOS after Mitigation	NI	LTS	LTS	LTS	LTS	LTS
Impact AQ-4: Exposure of Sensitive Receptors to Odor Emissions	LOS before Mitigation	NI	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required.	None needed; thus, none proposed.				
	LOS after Mitigation	NI	LTS	LTS	LTS	LTS	LTS
Impact AQ-5: Short-Term Emissions of Criteria Air Pollutants and Precursors Below Shasta Dam During Project Construction	LOS before Mitigation	NI	NI	NI	NI	LTS	LTS
	Mitigation Measure	None required.	None needed; thus, none proposed.				
	LOS after Mitigation	NI	NI	NI	NI	LTS	LTS
Impact AQ-6: Generation of Greenhouse Gases	LOS before Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required.	None needed; thus, none proposed.				
	LOS after Mitigation	LTS	LTS	LTS	LTS	LTS	LTS

Notes:
LOS = level of significance
LTS = less than significant
NA = not applicable
NI = no impact
PS = potentially significant
SU = significant and unavoidable

No-Action Alternative

No mitigation measures are needed for this alternative.

CP1 – 6.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability

No mitigation is needed for Impacts AQ-2 (CP1), AQ-3 (CP1), AQ-4 (CP1), AQ-5, and AQ-6 (CP1). Mitigation is provided below for the remaining impact of CP1 on air quality.

Mitigation Measure AQ-1 (CP1): Implement Standard Measures and Best Available Mitigation Measures to Reduce Emissions Levels Reclamation (referred to below as "the project applicant" or "the applicant") and its primary construction contractor(s) will implement the mitigation measures listed below to reduce emissions of criteria air pollutants and precursors generated during construction.

Standard Mitigation Measures The following SCAQMD standard mitigation measures are applicable to all projects.

PM_{10} Controls

- Alternatives to open burning of vegetative material on the project site shall be used by the project applicant unless otherwise deemed infeasible by SCAQMD. Among suitable alternatives is chipping, mulching, or conversion to biomass fuel.

- The applicant shall be responsible for ensuring that all adequate dust control measures are implemented in a timely and effective manner during all phases of project development and construction.

- All material excavated, stockpiled, or graded shall be sufficiently watered to prevent fugitive PM_{10} dust emissions from leaving the property boundaries and causing a public nuisance or a violation of an ambient air standard. Watering shall occur at least twice daily with complete site coverage, preferably in the mid-morning and after work is completed each day.

- All areas (including unpaved roads) with vehicle traffic shall be watered periodically or dust palliatives applied for stabilization of fugitive PM_{10} dust emissions.

- All on site vehicles shall be limited to a speed of 15 miles per hour on unpaved roads.

- All land clearing, grading, earthmoving, or excavation activities on a project shall be suspended when winds are expected to exceed 20 miles per hour.

- All inactive portions of the development site shall be seeded and watered until a suitable grass cover is established.

- The applicant shall be responsible for applying Shasta County Department of Public Works–approved nontoxic soil stabilizers (according to manufacturers' specifications) to all inactive construction areas (previously graded areas that remain inactive for 96 hours) in accordance with the Shasta County Grading Ordinance.

- All trucks hauling dirt, sand, soil, or other loose material shall be covered or maintain at least 2 feet of freeboard (i.e., minimum vertical distance between top of the load and the trailer) in accordance with the requirements of California Vehicle Code Section 23114. This provision shall be enforced by local law enforcement agencies.

- All material transported off site shall be either sufficiently watered or securely covered to prevent a public nuisance.

- During initial grading, earthmoving, or site preparation, the project shall be required to construct a paved (or dust palliative–treated) apron, at least 100 feet in length, onto the project site from the adjacent paved road(s).

- Paved streets adjacent to the development site shall be swept or washed at the end of each day to remove excessive accumulations of silt and/or mud that may have accumulated as a result of activities on the development site.

- Adjacent paved streets shall be swept (water sweeper with reclaimed water recommended) at the end of each day if substantial volumes of soil materials have been carried onto adjacent public paved roads from the project site.

- Wheel washers shall be installed where project vehicles and/or equipment enter and/or exit onto paved streets from unpaved roads. Vehicles and/or equipment shall be washed before each trip.

- Before final occupancy, the applicant shall reestablish ground cover on the construction site through seeding and watering in accordance with the Shasta County Grading Ordinance.

Streets

- The project shall provide for temporary traffic control as appropriate during all phases of construction to improve traffic flow as deemed appropriate by the Shasta County Department of Public Works and/or the California Department of Transportation.

- Construction activities shall be scheduled that direct traffic flow to off-peak hours as much as practicable.

Energy Conservation For any new or relocated structures, the following features will be incorporated as much as practicable:

- The project shall provide for the use of energy-efficient lighting, including controls, and process systems such as water heaters, furnaces, and boiler units.

- The project shall use a central water heating system featuring the use of low-NO_X hot water heaters.

Best Available Mitigation Measures None of the SCAQMD BAMMs are appropriate for the project. Therefore, the following measures will be incorporated into the project:

- The project applicant will prepare and submit to SCAQMD for approval a plan demonstrating that the heavy-duty (equal to or greater than 50 horsepower) off-road vehicles to be used in the construction project, including owned, leased, and subcontractor vehicles, shall achieve a projectwide fleet-average 20 percent NO_X reduction and 45 percent particulate reduction compared to the most recent ARB fleet average at time of construction. Acceptable options for reducing emissions may include use of late-model engines, low-emission diesel products, alternative fuels, engine retrofit technology, after-treatment products, and/or other options as they become available.

- The project applicant will locate all construction equipment maintenance and staging areas at the farthest distance possible from nearby sensitive land uses.

- Idling of diesel-powered vehicles and equipment will not be permitted during periods of nonactive vehicle use. Diesel-powered engines will not be allowed to idle for more than 5 consecutive minutes in a 60-minute period when the equipment is not in use, occupied by an operator, or otherwise in motion, except under the following conditions:

  – When equipment is forced to remain motionless because of traffic conditions or mechanical difficulties over which the operator has no control

  – When it is necessary to operate auxiliary systems installed on the equipment, only when such system operation is necessary to accomplish the intended use of the equipment

- To bring the equipment to the manufacturer's recommended operating temperature
- When the ambient temperature is below 40ºF or above 85ºF
- When equipment is being repaired

Implementation of the above mitigation measure would reduce ROG, NO_X, and PM_{10} emissions from on-site heavy-duty equipment exhaust by approximately 5 percent, 20 percent, and 45 percent, respectively, and fugitive PM_{10} dust emissions by 75 percent. However, NO_X emissions generated during construction would still exceed the SCAQMD Level B threshold of 137 lb/day. Thus, this impact would be significant and unavoidable**.**

CP2 – 12.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability

No mitigation is needed for Impacts AQ-2 (CP2), AQ-3 (CP2), AQ-4 (CP2), AQ-5, and AQ-6 (CP2). Mitigation is provided below for the remaining impact of CP2 on air quality.

Mitigation Measure AQ-1 (CP2): Implement Standard Measures and Best Available Mitigation Measures to Reduce Emissions Levels This mitigation measure is identical to Mitigation Measure AQ-1 (CP1). For the reasons described above under Mitigation Measure AQ-1 (CP1), this impact would be significant and unavoidable.

CP3 – 18.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply

No mitigation is needed for Impacts AQ-2 (CP3), AQ-3 (CP3), AQ-4 (CP3), AQ-5, and AQ-6 (CP3). Mitigation is provided below for the remaining impact of CP3 on air quality.

Mitigation Measure AQ-1 (CP3): Implement Standard Measures and Best Available Mitigation Measures to Reduce Emissions Levels This mitigation measure is identical to Mitigation Measure AQ-1 (CP1). For the reasons described above under Mitigation Measure AQ-1 (CP1), this impact would be significant and unavoidable.

CP4 – 18.5-Foot Dam Raise, Anadromous Fish Focus with Water Supply Reliability

No mitigation is needed for Impacts AQ-2 (CP4), AQ-3 (CP4), AQ-4 (CP4), AQ-5, and AQ-6 (CP4). Mitigation is provided below for the remaining impact of CP4 on air quality.

Mitigation Measure AQ-1 (CP4): Implement Standard Measures and Best Available Mitigation Measures to Reduce Emissions Levels This mitigation measure is identical to Mitigation Measure AQ-1 (CP1). For the reasons described above under Mitigation Measure AQ-1 (CP1), this impact would be significant and unavoidable.

CP5 – 18.5-Foot Dam Raise, Combination Plan

No mitigation is needed for Impacts AQ-2 (CP5), AQ-3 (CP5), AQ-4 (CP5), AQ-5, and AQ-6 (CP5). Mitigation is provided below for the remaining impact of CP5 on air quality.

Mitigation Measure AQ-1 (CP5): Implement Standard Measures and Best Available Mitigation Measures to Reduce Emissions Levels This mitigation measure is identical to Mitigation Measure AQ-1 (CP1). For the reasons described above under Mitigation Measure AQ-1 (CP1), this impact would be significant and unavoidable.

5.3.6 Cumulative Effects

The effects of climate change on operations at Shasta Lake could potentially result in changes downstream. As described in the Climate Change Projection Appendix, climate change could result in higher reservoir releases in the future due to an increase in winter and early spring inflow into the lake from high intensity storm events. The change in reservoir releases could be necessary to manage for flood events resulting from these potentially larger storms. The potential increase in releases from the reservoir could lead to long-term changes in downstream channel equilibrium.

Growth is likely to occur throughout the primary and extended study areas and some future projects are reasonably foreseeable, but substantial increases in emissions of criteria air pollutants or precursors in the primary and extended study areas are unlikely to make a cumulatively considerable contribution to an overall cumulatively significant impact on air quality. For cumulative effects of climate change on other resource areas, please see the "Cumulative Effects" sections in other chapters of this PDEIS.

Shasta Lake and Vicinity and Upper Sacramento River (Shasta Dam to Red Bluff)

Under the project alternatives (CP1–CP5), construction activities would result in short-term emissions of ROG, NO_X, and PM_{10} that without mitigation would exceed applicable SCAQMD thresholds. After implementing the best available and all feasible mitigation measures, ROG and PM_{10} emissions would not exceed applicable thresholds; and in combination with past, present, and reasonably foreseeable future projects, would not result in an overall cumulatively significant impact. Therefore, with mitigation, these emissions would not be cumulatively considerable. Emissions of NO_X, however, would still exceed the applicable SCAQMD threshold after implementation of the best available mitigation measures. These emissions would be cumulatively considerable, and this would be a cumulatively significant and unavoidable impact.

Operation of any of the action alternatives would not result in cumulatively considerable emissions of ROG, NO_X, and PM_{10}. Also, neither short-term construction nor long-term operational sources would expose sensitive receptors

to substantial concentrations of CO, PM_{10}, $PM_{2.5}$, TACs, or odors. None of these emissions would be cumulatively considerable contributions to a significant cumulative impact of ROG, NO_X, and PM_{10}.

Lower Sacramento River and Delta and CVP/SWP Service Areas

The project alternatives would not generate any short-term or long-term air pollutant emissions in the extended study area. Therefore, there would be no cumulative air quality impact.

Global Study Area—Climate Change

As discussed in Section 5.1, "Affected Environment," of this chapter, climate change is a global phenomenon. All GHG emissions are considered cumulative. The impact analyses for Impacts AQ-6 (CP1), AQ-6 (CP2), AQ-6 (CP3), AQ-6 (CP4), and AQ-6 (CP5), in Section 5.3.4, "Direct and Indirect Effects," of this chapter are cumulative analyses. All five project alternatives (CP1–CP5) would result in short-term cumulative impacts that would be less than the suggested significance threshold for this cumulative effect, and therefore are considered to not make a cumulatively considerable incremental contribution to a significant cumulative impact, and would have beneficial long-term effects. For cumulative effects of climate change on other resource areas, please see the "Cumulative Effects" sections in other chapters of this PDEIS.